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VALIDATING THE CONSTRUCTS OF EMPLOYEES' COMPETENCE MODEL TROUGH CONFIRMATORY FACTOR ANALYSIS: EVIDENCE FROM NIGERIA

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ABSTRACT

In recent decades, the confirmatory factor analysis (CFA) has been embraced by several scholars in assessing the fitness of measurement model through structural equation modeling procedure. In this study, five variables namely HRM practices (recruitment and selection, training and development, performance appraisal, compensation), psychological empowerment, affective commitment, work engagement, and employee competence were applied in carrying out the CFA. Applying the CFA procedure determines the researcher's attempt to increase the ability of latent measurement model to be more outlined and précised in drawing conclusions as well as avoiding the violation of regression assumption. It appears more efficient with the use of Cronbach Alpha, Convergent validity, Discriminant Validity and Composite Reliability in the study analysis for the researcher to apply the result for further steps. Hence, findings of this study appear to be more corresponding with the overall aim of the study. Empirically, CFA is an effective tool for ensuring the best fit of measurement model. The inability of the current analysis to carry out the CFA using individual measurement serves as a great limitation. The application of pooled CFA is certainly a key to researchers in the quest to achieve the requirement for measurement model in a study with complex constructs/items. This paper aimed at presenting to the readers particularly those at the beginning stage, the importance of applying pooled CFA in empirical studies by highlighting the findings of the current study.

Keywords: Validating, Employee Competence, Nigerian, Basic Education System, Pooled Confirmatory Factor Analysis

INTRODUCTION

The application of Confirmatory factor analysis (CFA) through structural equation modeling has been enjoyed by various scholars and researchers in achieving the objectives of their empirical studies (Afthanorhan et al., 2014). This statistical tool helps researchers in evaluating the fitness of different latent measurement model and also preventing researchers from attaining wrong estimation in predicting the significant, strength and purpose of the variables involved in a particular model. Besides, the application of CFA does not only limit itself to statistical areas but also required in various field of science such as psychology, economics, business, marketing as well as other related fields associated with analytical skills (Afthanorhan et al., 2014). In relation to social science, this paper employed employee competence in Nigerian Universal Basic Education system Administration (UBESA) as research subject to be statistically tested through the CFA analysis in order to assist authors in identifying the fitness of measurement model with the ease of proposed fitness measurement model. Specifically, this paper contains five variables namely HRM practices (recruitment and selection, training and development, performance appraisal, compensation), psychological empowerment, affective commitment, work engagement and employee competence

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that undergoes through such procedure in the quest to improve the capabilities and fitness of measurement model in the study.

METHODS

The structural equation modeling helps researchers to manage their variables and also calculate the estimation of various manifested variables (indicators) applied rather than depending on the integrating mean to overcome problems. Based on statistical assumption, the error of mean should always be zero which is completely rejected in computing the mean in assisting research work (Afthanorhan et al., 2014). In application of the CFA analysis, the above-mentioned variables started with the unidimentionality process in order to identify and delete those items below 0.60. According to Awang, (2012), any item below 0.60 should be removed because its value has insignificant influence to the research subject. Thus, the values are shown on the next arrow close to the end of the rectangular shape reflecting the latent measurement model. When the specifications are completed, the fitness indexes were considered. While using the assessments of fitness indexes like the Root Mean Square Error Approximation (RMSEA), incremental fit and baseline comparison are deemed fit as the measurement fitness in measuring the level of model fitness. Hence, all the variables involved in the study are considered based on previous studies to examine the relationship between the exogenous and endogenous constructs. Nevertheless, this research work aimed at evaluating the fitness of the measurement model using structural equation modeling and presenting the pooled CFA.

Nigeria Universal Basic Education System Administration

As Mentioned earlier, Nigerian Universal Basic Education system has five Variables namely; HRM practices (recruitment and selection, training and development, performance appraisal, compensation), psychological empowerment, affective commitment, work engagement, employee competence. These variables consist of 88 items developed for the specific population using questionnaire. Hence, the questionnaire was administered to the selected respondents using 10- Likert scale for them to answer all the questions regarding employee competence in Nigerian UBESA. Applying the pooled-CFA in analysis of complex subject matter, helps the researcher in ascertaining the suitability of the questionnaire developed in attaining the objectives of the study.

Confirmatory Factor Analysis Procedure for Validating Measurement Model in this Study.

Confirmatory factor analysis is considered as the validation process which takes place through measurement model. It is used in order to ensure the instruments intended to use for a particular study are appropriate (Harrington, 2009). This category of analysis requires some certain number of components and the items involved reflect the components as well as the correlation between the given components (Thompson, 2004). The technique is usually performed before employing the use Structural Equation Madeline (SEM) for the entire latent constructs (Awang, 2012; Shih-I, 2011). In the same vein, the confirmatory factor analysis is seen as a procedure used in validating the convergent and discriminant validity after the structural equation modeling might have been executed (Chua, 2009). Hence, as a method of confirming the factor structure of a group of observed variables, the CFA is required in order to enable the researcher explore the hypotheses on the link between the observed and the latent constructs (Kashif et al., 2016; Moss, 2016). Thus, this process was observed before using Structural Equation Modeling (SEM) for the entire latent constructs (Awang, 2012; Shih-I, 2011). The study tested all the measurement models of the given latent construct to ensure the validity and reliability as well as unidimensionality before executing the structural model. The overall process is called Confirmatory Factor Analysis (Awang, 2014; Moss, 2016; Suhr, 2006).

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RESULTS AND DISCUSSIONS

However, the convergent validity, construct validity and discriminant validity were required at this stage for the measurement model of the latent constructs (Awang, 2014). The convergent validity was measured through the measurement model's fitness index and the average variance extracted was also evaluated. While the discriminant and convergent validity were assessed through the discriminant validity index summary (Awang, 2012; Hair et al., 2010). In relation to reliability, the composite reliability (CR) was evaluated. Although, it replaces the Cronbach Alpha's internal reliability for the analysis utilizing the structural equation modeling procedure (Kashif et al., 2016; Tajudin & Saad, 2016). The construct is considered valid only when its actual fitness indexes have acquired the main three types of model fit such as; incremental fit, parsimonious fit and absolute fit (Awang, 2012, 2014, 2015). The index fit categories and their respective thresholds for fitness indexes are presented in Table 1.

Table 1. The three categories of model fit and their level of acceptance

Name of category	Name of index	Level of acceptance
	Chi-Square	P-value > 0.05
Absolute Fit Index	**RMSEA**	RMSEA < 0.08
	GFI	GFI > 0.85, Ideal if > 0.90
Incremental Fit Index	AGFI	AGFI > 0.85, Ideal if > 0.90
	CFI	CFI > 0.85, Ideal if > 0.90
	TLI	TLI > 0.85, Ideal if > 0.90
	NFI	NFI > 0.85, Ideal if > 0.90
Parsimonious Fit Index	**ChiSq /df**	Chi-Square/ df < 5.0, Ideal if < 3.0

***The indexes in bold are recommended since they are frequently reported in literatures
Source: (Awang, 2015)

Hence, this study has three exogenous constructs, one mediator construct as well as one endogenous construct. The exogenous constructs consist of HRM practices (recruitment and selection, training and development, performance appraisal, compensation), psychological empowerment and affective commitment. Work engagement is the mediating construct and the endogenous construct is employee competence. Largely, picture of the study framework is presented in Figure 1.

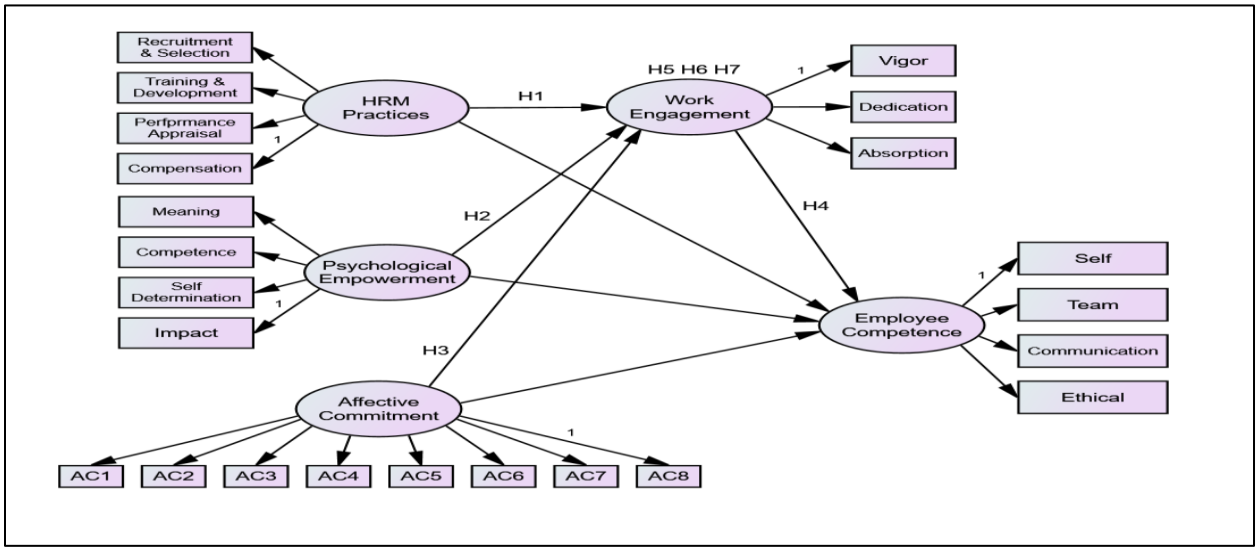

Figure 1. The study framework

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The measurement model of all the exogenous constructs, the mediating construct and the endogenous construct is complicated as it involves various sub-constructs (components) and many items involved in each of the construct and sub-construct. Based on the complicated nature of this study, the researcher decided to calculate the CFA individually for each measurement model and later conducted the pooled CFA after all the constructs have achieved the required fitness thresholds (Awang, 2015; Kashif et al., 2016). The study combined the entire constructs in a single model and performed the pooled-CFA to measure the discriminant validity among the study constructs. Considering the complicated nature of the given constructs, the study decided to make it easier by transforming the second order construct into first order by calculating the composite mean for every sub-construct (component) (Awang, 2015; Kashif et al., 2016). Meanwhile, before modeling the structural model and executing SEM, the researcher ensures all constructs and the model itself are discriminant of each other or not exceptionally correlated between the exogenous and endogenous constructs predominantly (Awang, 2015; Bakar & Afthanorhan, 2016). In case of exogenous constructs happens to be extremely correlated (greater than 0.85), it means there is serious problem called multi-collinearity.

The CFA Procedure for Validating HRM Practices constructs

As mentioned earlier, HRM practices construct having sub-constructs in the model (second order construct) as shown in figure 2. The factor loading for all the sub-constructs, the fitness indexes and factor loading for each item as actually presented. Considering the result in 2, the researcher can easily access the reliability and validity for the given construct.

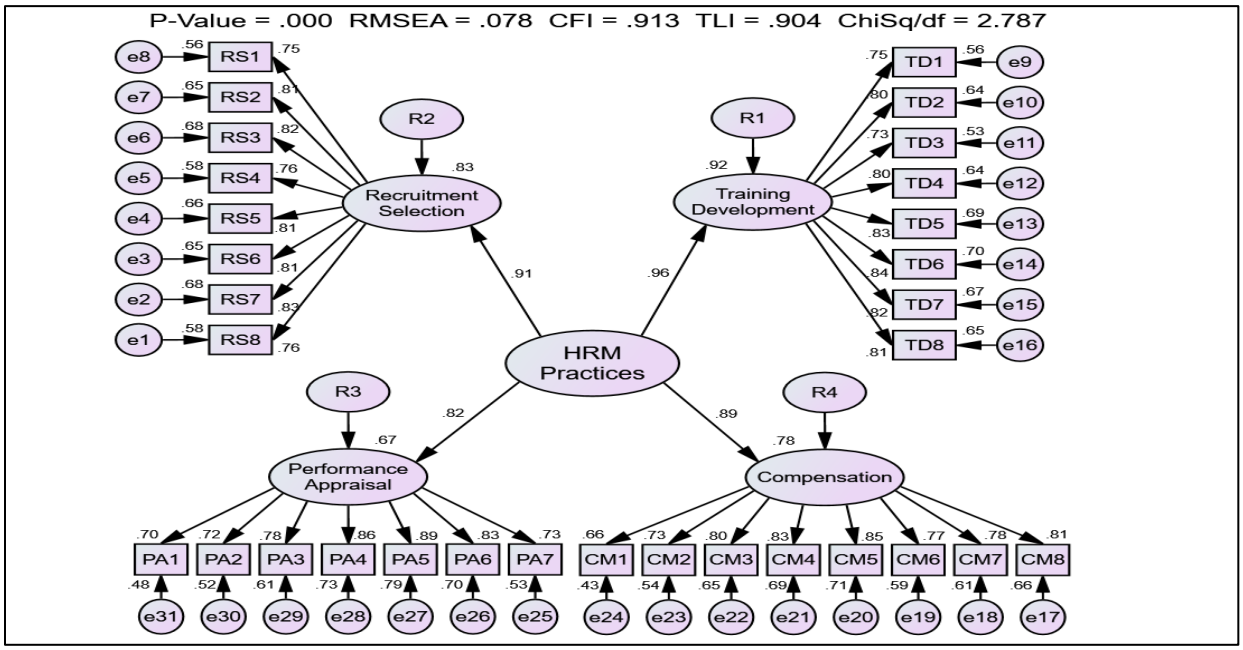

Figure 2. The CFA results for HRM Practices construct.

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As revealed in 2, the fitness indexes have met the threshold value and the fitness fit type such as RMSEA is revealed to be 0.078 which has achieved the required threshold value. Likewise, the incremental fitness known as CFI is revealed to be 0.913 which has also attained the required threshold value. Again, the parsimonious fitness such as the ration of Chisq/df is seen to be 2.787 which has also achieved the required threshold value. Thus, HRM practices construct measurement model have attained the prerequisite for the construct validity (Awang et al., 2018; Bahkia et al., 2019; Mohamad et al., 2018). The convergent validity was assessed through computing the average variance extracted (AVE). Hence, the validity of the construct has been attained considering the fact that threshold value has exceeded 0.5 of the requirements (Afthanorhan et al., 2020; Rahlin et al., 2019; Sarwar et al., 2020). While trying to assess the composite reliability, the CR was computed and its value was shown to be higher than the required threshold value of 0.6 as the requirement for achieving reliability (Awang et al., 2018; Mohamad et al., 2018). The AVE and CR are computed for the main constructs and the sub-constructs are shown in Table 2.

Table 2. The Average Variance Extracted (AVE) and Composite Reliability (CR) for the construct HRM Practices

Construct	Item	Factor Loading	CR (above 0.6)	AVE (above 0.5)
HRM Practices	Recruitment and Selection	.91	**.942**	**.804**
	Training and Development	.96		
	Performance Appraisal	.82		
	Compensation	.89		
Recruitment and Selection	RS1	.75	**.933**	**.635**
	RS2	.81		
	RS3	.82		
	RS4	.78		
	RS5	.81		
	RS6	.81		
	RS7	.83		
	RS8	.76		
Training and Development	TD1	.75	**.933**	**.637**
	TD2	.80		
	TD3	.73		
	TD4	.80		
	TD5	.83		
	TD6	.84		
	TD7	.82		
	TD8	.81		
Performance Appraisal	PA1	.70	**.920**	**.624**
	PA2	.72		
	PA3	.78		
	PA4	.86		
	PA5	.89		
	PA6	.83		
	PA7	.73		
Compensation	CM1	.66	**.935**	**.643**
	CM2	.73		
	CM3	.86		
	CM4	.83		
	CM5	.85		
	CM6	.87		
	CM7	.78		
	CM8	.81		

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The CFA Procedure for Validating Psychological Empowerment constructs

The Psychological Empowerment construct as mentioned earlier is said to be a second order construct which has three sub-constructs as revealed in Figure 3. The fitness indexes for the entire construct, the factor loading for every item, and the factor loading for every sub-construct (component) are presented in Figure 3.

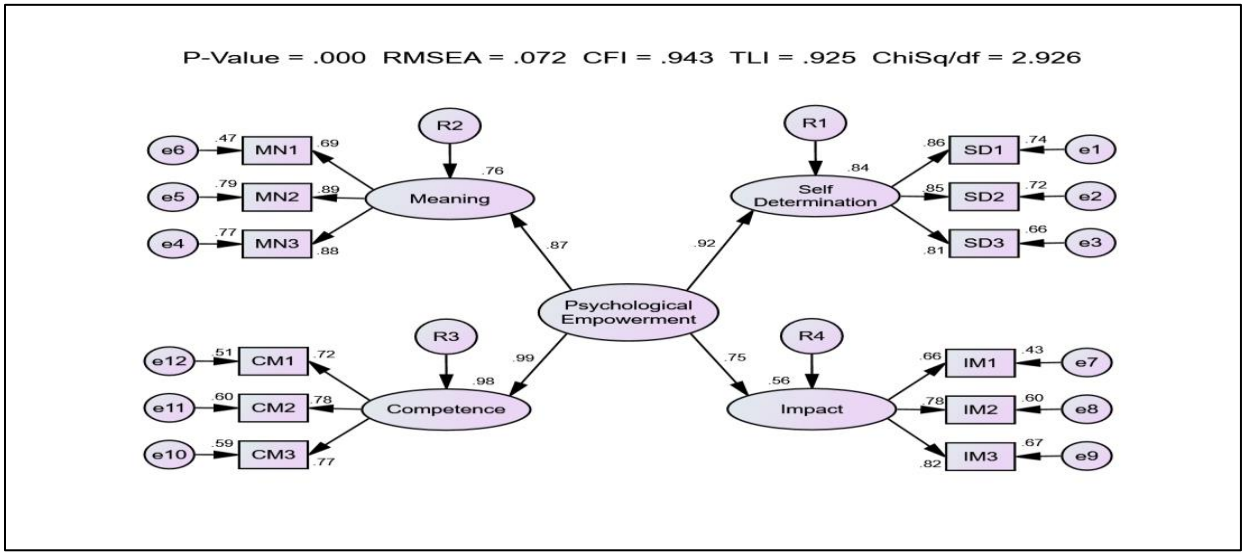

Figure 3. The CFA results for Psychological Empowerment construct.

As indicated in Figure 3, the fitness indexes have achieved the required which can be seen in Table 1. Again, the absolute fitness known as RMSEA is seen to be 0.072 which has attained the required value of less than 0.08. Likewise, the incremental fitness such as CFI is revealed to be 0.943 which have achieved the threshold value of 0.90. Similarly, the parsimonious fitness known as ratio of Chisq/df is revealed to be 2.926 which has attained the required threshold value of less than 3.0. Therefore, the psychological empowerment construct measurement model have said to achieve the required construct validity in this study (Afthanorhan et al., 2020; Rahlin et al., 2019b; Sarwar et al., 2020). While trying to assess the convergent validity, the average variance extracted (AVE) in this study was computed. According to Awang et al., (2018) and Muda et al., (2018), a construct can only achieve its convergent validity when the AVE exceeds the threshold value of 0.5. In assessing the composite reliability, the study calculated the CR and its value which have exceeded the threshold value of 0.6 as required for the reliability. Thus, the AVE and CR for the main constructs and their respective sub-constructs are calculated and presented in Table 3.

Table 3. The Psychological Empowerment Construct Average Variance Extracted (AVE) and Composite Reliability (CR)

Construct	Item	Factor Loading	CR (above 0.6)	AVE (above 0.5)
Psychological Empowerment	Meaning	.87	**.936**	**.786**
	Self Determination	.92		
	Competence	.99		
	Impact	.75		

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Meaning	MN1	.69	**.863**	**.681**
	MN2	.89		
	MN3	.88		
Self Determination	SD1	.86	**.878**	**.706**
	SD2	.85		
	SD3	.81		
Competence	CM1	.72	**.801**	**.573**
	CM2	.78		
	CM3	.77		
Impact	IM1	.66	**.799**	**.572**
	IM2	.78		
	IM3	.82		

The CFA Procedure for Validating Work Engagement constructs

As mentioned earlier, the work engagement construct is conceived as second order construct which has three Sub-components in the construct as revealed in Figure 1.4. The fitness indexes for the entire constructs, the factor loading for each item in the constructs, while the factor loading for each of the sub-component for the purpose of assessing the validity and reliability are also shown in Figure 4.

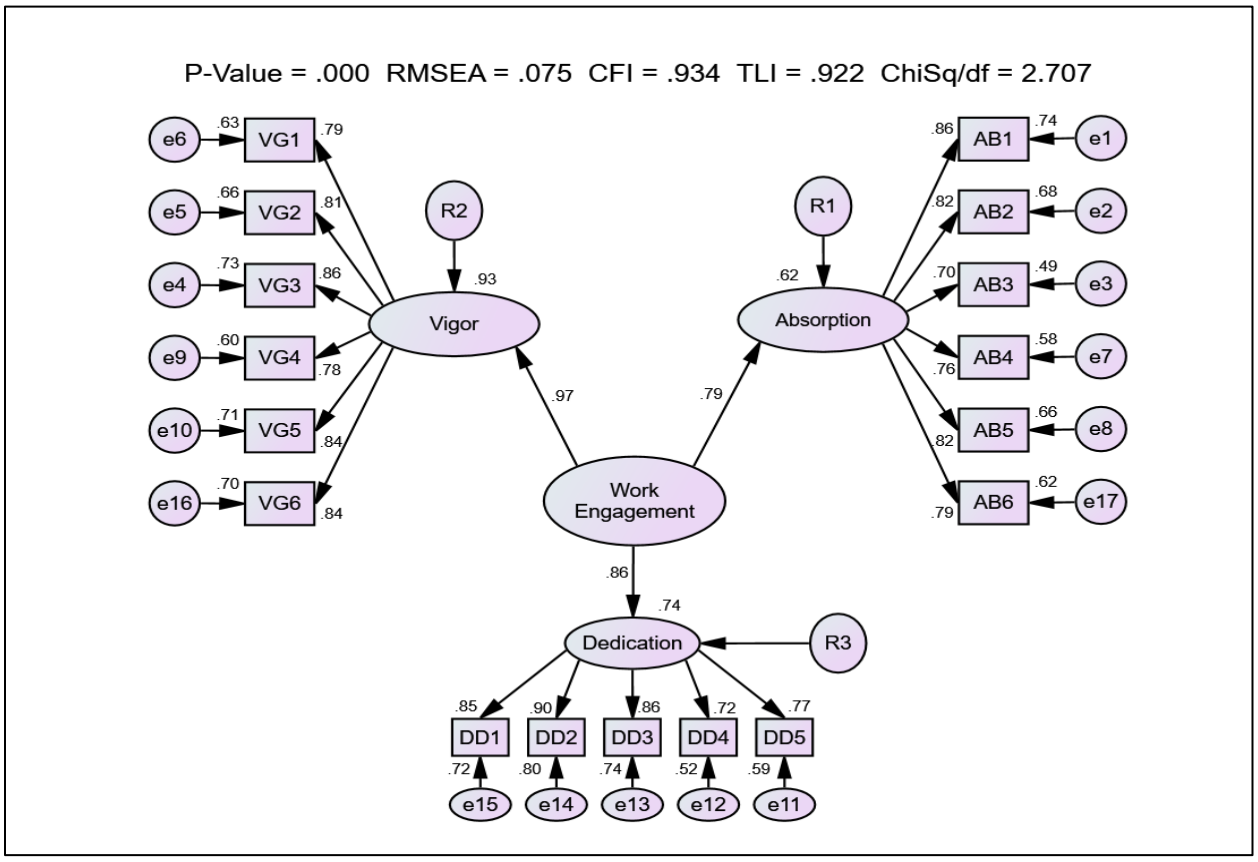

Figure 4. The CFA results for Work Engagement construct.

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As seen in Figure 4, the fitness indexes have attained the required threshold value as presented in Table 1. and the absolute fitness category known as RMSEA is shown to be 0.075 which have achieved the threshold the required value of less than 0.08. The incremental fitness such as CFI is 0.934 which have attained the threshold value of less than 3.0. The work engagement construct measurement model has achieved the required construct validity (Afthanorhan et al., 2020; Sarwar et al., 2020). In assessing the convergent validity, the average variance extracted (AVE) was calculated. Hence, the convergent validity has been achieved since AVE is higher than the required threshold value of 0.5 (Mahfouz et al., 2020; Rahlin et al., 2019b). While for the purpose of assessing the composite reliability, the CR was calculated and the value has exceeded the required threshold value of 0.6 and the construct validity is attained (Awang, 2014; Muda et al., 2018). The AVE and CR for the main constructs and their respective sub-components are calculated and presented in Table 4.

Table 4. The Work Engagement Construct Average Variance Extracted (AVE) and Composite Reliability (CR)

Construct	Item	Factor Loading	CR (above 0.6)	AVE (above 0.5)
Work Engagement	Vigor	.97	**.908**	**.768**
	Absorption	.79		
	Dedication	.86		
Vigor	VG1	.79	**.925**	**.673**
	VG2	.81		
	VG3	.86		
	VG4	.78		
	VG5	.84		
	VG6	.84		
Absorption	AB1	.86	**.910**	**.629**
	AB2	.82		
	AB3	.70		
	AB4	.76		
	AB5	.82		
	AB6	.79		
Dedication	DD1	.85	**.912**	**.677**
	DD2	.90		
	DD3	.86		
	DD4	.72		
	DD5	.77		

The CFA Procedure for Validating Employee Competence constructs

As mentioned earlier, the employee competence construct in this study is termed as second order construct which contains four sub-dimensions as seen in Figure 5. The entire fitness indexes for the study constructs and the factor loading for every single item is presented. Hence, the constructs reliability and validity could be assessed in Figure 5.

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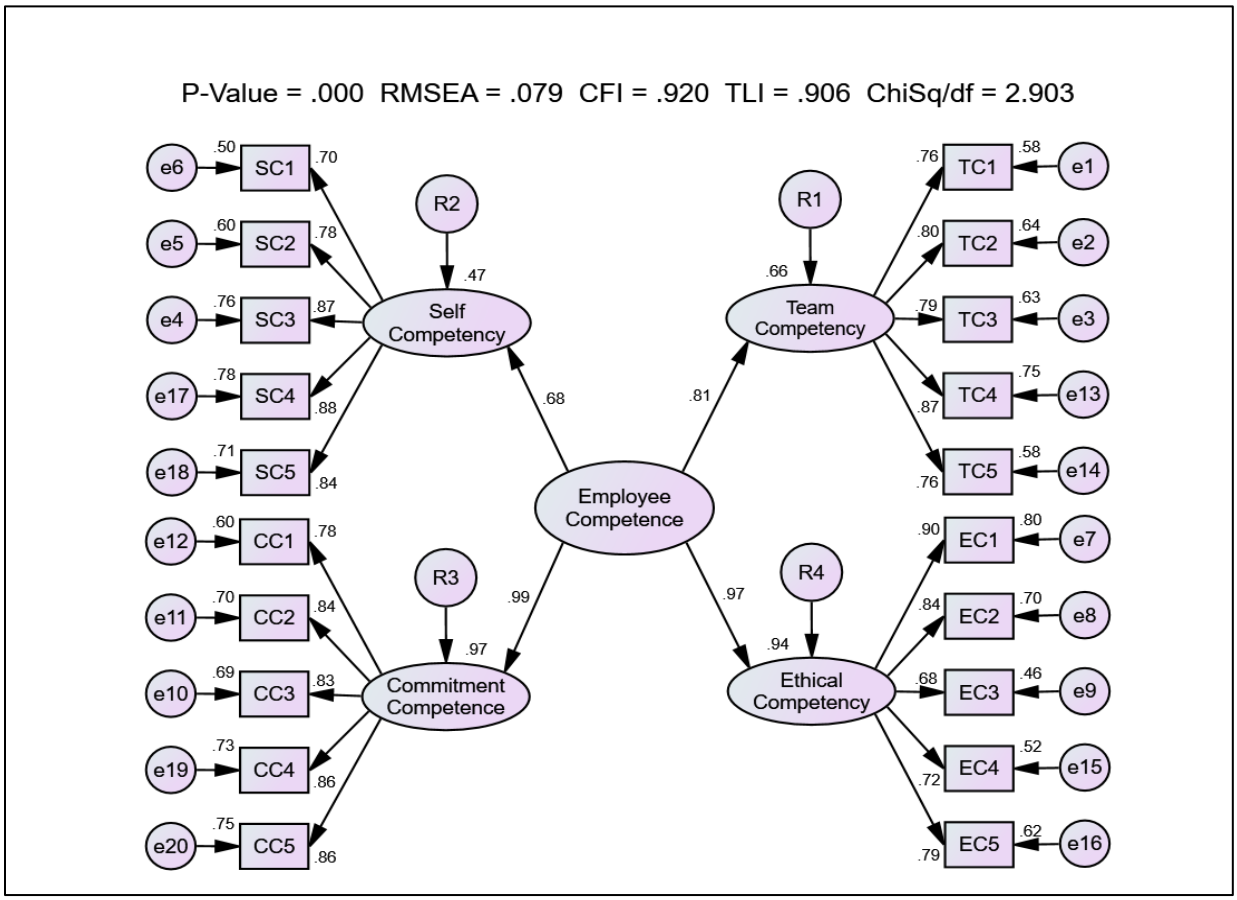

Figure 5. The CFA results for Employee Competence construct

As seen in Figure 5, the fitness indexes have achieved the threshold values as stated in 1. While the absolute fitness known as RMSEA is seen to be 0.079 which have attained the required threshold value of less than 0.08. Likewise, the incremental fitness known as CFI is seen as 0.920 which have also achieved the required threshold value of less than 0.90. Again, the parsimonious fitness such as the ration of Chisq/df is seen to be 2.903 which has attained the threshold value of less than 3.0. Thus, the employee's competence construct has achieved the required construct validity for the purpose of this research work (Bahkia et al., 2019; Mohamad et al., 2018). While in attempt to assess the convergent validity, the researcher calculated the average variance extracted (AVE). Hence, the convergent validity for the construct have been achieved since the its value have exceeded the required threshold value of 0.5 (Mahfouz et al., 2020). Finally, the CR and its actual value was calculated for the purpose of assessing the composite reliability in the study which is reported to be higher than required threshold value of 0.6 and attained the construct reliability (Awang, 2014). Table 1.5 revealed the AVE, CR, the main construct, as well as their sub-components as calculated.

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Table 5. The Employee Competence Construct Average Variance Extracted (AVE) and Composite Reliability (CR)

Construct	Item	Factor Loading	CR (above 0.6)	AVE (above 0.5)
Employee Competence	Self-Competency	.68	**.925**	**.760**
	Team Competency	.81		
	Communication Competency	.99		
	Ethical Competency	.97		
Self-Competency	SC1	.70	**.909**	**.667**
	SC2	.78		
	SC3	.87		
	SC4	.88		
	SC5	.84		
Team Competency	TC1	.76	**.907**	**.662**
	TC2	.80		
	TC3	.87		
	TC4	.87		
	TC5	.76		
Communication Competency	CC1	.78	**.920**	**.696**
	CC2	.84		
	CC3	.83		
	CC4	.86		
	CC5	.86		
Ethical Competency	EC1	.90	**.916**	**.687**
	EC2	.84		
	EC3	.88		
	EC4	.72		
	EC5	.79		

The Pooled-CFA for all Measurement Model of Constructs

The pooled construct is presented in Figure 6. At this stage, the measurement model for the entire second order constructs have been validated through CFA process distinctly and later shortened into first order constructs respectively in order to reduce its complexity (Awang, 2015). The rationale behind running the said pooled-CFA for the entire constructs collectively for easy assessment of the discriminant validity among the constructs in the given model (Afthanorhan et al., 2017; Mohamad et al., 2016). The pooled-CFA procedure for assessing all latent constructs at once is presented in Figure 6.

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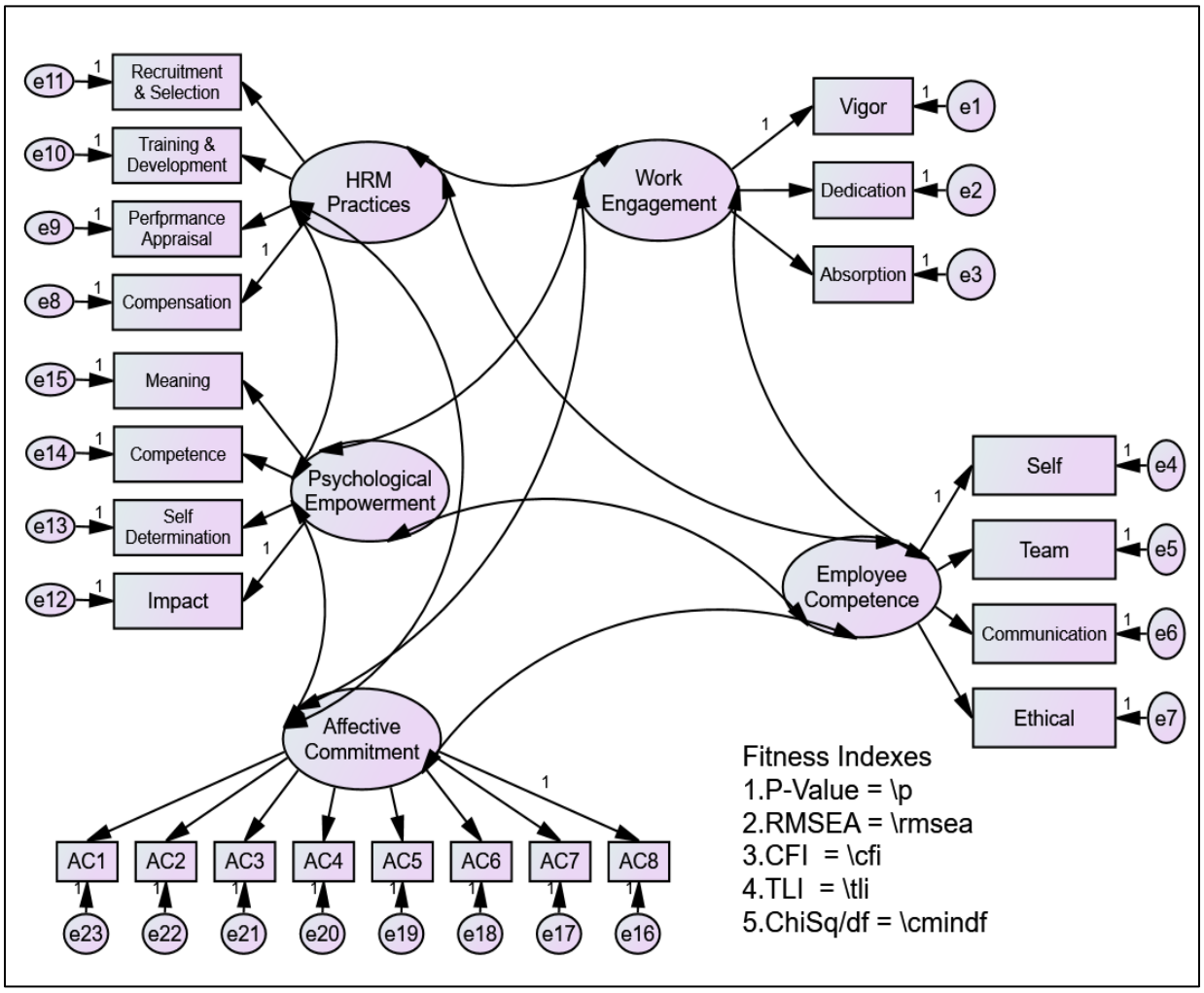

Figure 6. The pooled measurement model for estimating the correlation between constructs

The results for the pooled-CFA for the model presented in Figure 6, is shown in Figure 7. The output revealed the fit indexes for the entire constructs in the given model, the factor loading for all sub-component of construct measure the main construct. Also, the correlation between the constructs in the model. Similarly, the fitness indexes should meet the required threshold value as indicated in Table 1.1, the actual factor loading for each of the item should attain the minimum of 0.6 while the correlation coefficient of any of the two constructs should be less than 0.85 (Aziz et al., 2016; Raza & Awang, 2020; Yusof et al., 2017). Thus, the problem of multi-collinearity usually occurs when the correlation between any two constructs exceeds 0.85. Looking at the correlation values at the double-headed arrow in Figure 7, none of the value found to be greater than 0.85. Hence, the multi-collinearity problem does not arise in this study.

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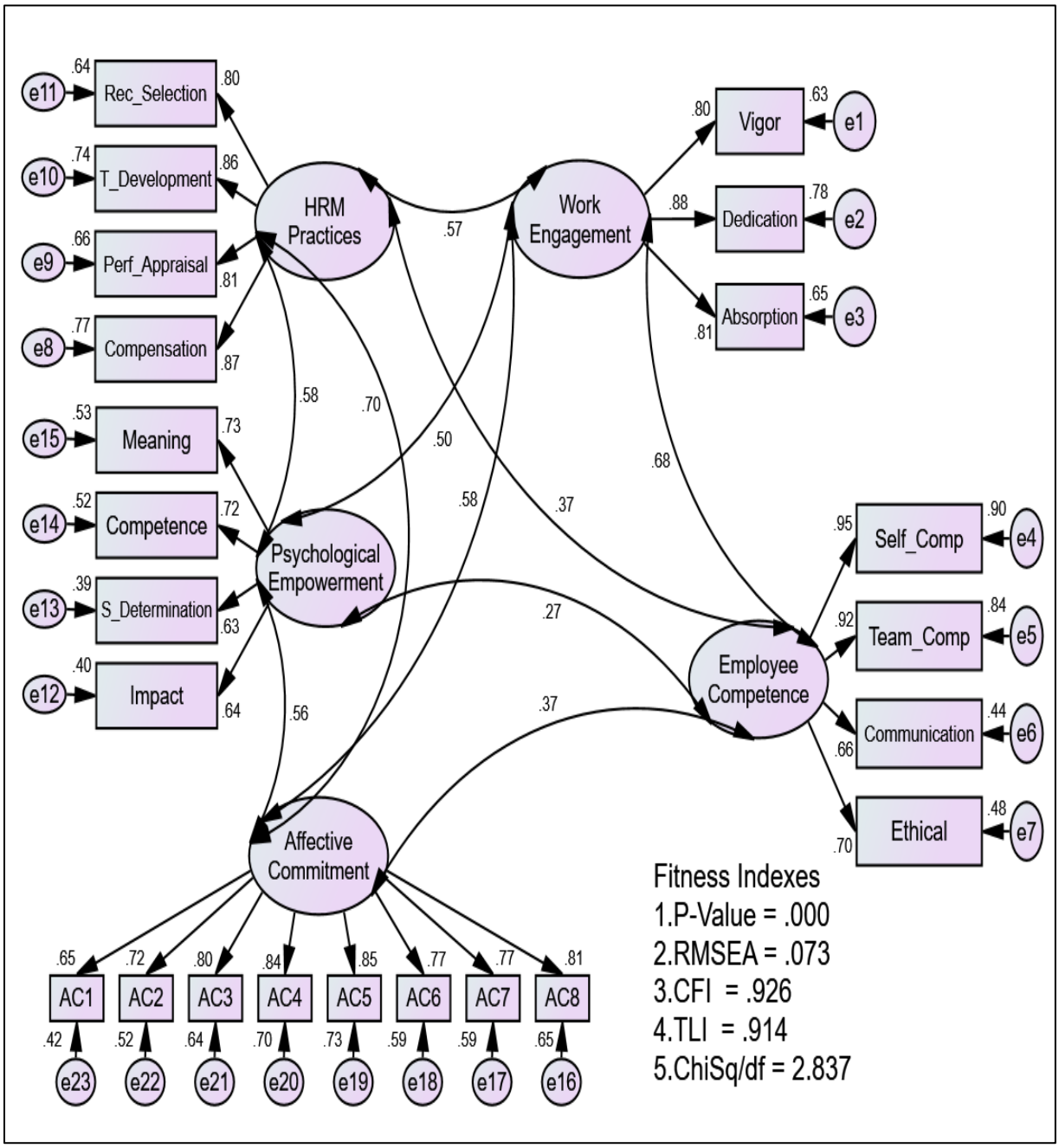

Figure 7. The CFA results for the pooled measurement model of all constructs

As shown in Figure 7, the required fitness indexes have been achieved as shown in Table 1. Thus, the absolute fitness known as RMSEA is seen to be 0.073 which has exceeded the threshold value of less than 0.08. while the incremental fitness category known as CFI is 0.926 which has met the required threshold value of less than 3.0. Hence, the constructs measurement model revealed in Figure 1.7 has achieved the required construct validity (Bahkia et al., 2019; Raza & Awang, 2020). For the purpose of assessing the convergent validity, the researcher calculated the average variance extracted (AVE). Thus, the convergent validity have been achieved since it has attained the threshold

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value of 0.5 (Afthanorhan et al., 2017; Mahfouz et al., 2020). Likewise, the composite reliability was achieved through calculating the CR and its value which shown to be higher than the required threshold value of 0.6 (Asnawi et al., 2019; Mahfouz et al., 2020). Table 1.6 indicated the AVE and CR for all the construct as calculated.

Table 6. The Average Variance Extracted (AVE) and the Composite Reliability (CR) for constructs in the model

Construct	Item	Factor Loading	CR (above 0.6)	AVE (above 0.5)
HRM Practices	Rec & Selection	.80	**.902**	**.698**
	T. Development	.86		
	Perf. Appraisal	.81		
	Compensation	.87		
Psychological Empowerment	Meaning	.73	**.799**	**.500**
	Competence	.72		
	Determination	.73		
	Impact	.64		
Affective Commitment	AC1	.65	**.925**	**.606**
	AC2	.72		
	AC3	.80		
	AC4	.84		
	AC5	.85		
	AC6	.77		
	AC7	.77		
	AC8	.81		
Employee Competence	Self-Competency	.95	**.887**	**.669**
	Team Competency	.92		
	Communication Competency	.66		
	Ethical Competency	.70		
Work Engagement	Vigor	.80	**.870**	**.690**
	Dedication	.88		
	Absorption	.81		

Based on the composite reliability (CR) values and average variance extracted (AVE) in Table 6, the study found all CR and AVE higher than the required threshold values of 0.5 as well as 0.6 (Mohamad et al., 2019; Sarwar et al., 2020). Therefore, the study concludes that the composite reliability and the convergent validity of all the latent constructs involved in the model have been achieved. However, the study needs to assess another type of validity known as the discriminant validity. It is an assessment usually conducted so as to ensure that redundant construct does not exist in the model. Thus, redundancy usually occurs when there is high level correlation between constructs. While assessing the discriminant validity, the study developed the discriminant validity index as shown in Table 1.7. Likewise, the diagonal values which are indicated in bold represent the actual square root of AVE of the respective constructs. Also, the other values are believed to represent the correlation coefficient between constructs. Considering Table 1.7, the discriminant validity of construct is been attained since the square root of AVE is higher than the correlation value among other constructs in the study model (Awang, 2015; Awang et al., 2018).

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Table 7. The Discriminant Validity Index Summary for all Constructs

Construct	HRM Practices	Psychological Empowerment	Affective Commitment	Employee Competence	Work Engagement
HRM Practices	**0.84**				
Psychological Empowerment	0.58	**0.71**			
Affective Commitment	0.70	0.56	**0.78**		
Employee Competence	0.37	0.27	0.37	**0.82**	
Work Engagement	0.57	0.50	0.58	0.68	**0.83**

Findings

As presented in the previous section, all the variables involved in the study have been measured individually. The essence of measuring all the latent constructs individually is to ensure the appropriateness of all the items involved in every construct in the study before applying the pooled CFA to harmonized the entire constructs in a single measurement model. In an attempt to ensure the appropriateness of the constructs/items used for the purpose of this study, the researcher carried out the CFA procedure to the entire individual constructs. The findings reveal that the entire constructs involved in this study have attained the required fitness indexes as revealed in the Table 1. Similarly, the absolute fitness category known as RMSEA have also been achieved (the entire constructs have attained the threshold value of less than 0.08). All the measurement model for the entire constructs have met the required prerequisite for construct validity. The convergent validity for the entire constructs was assessed and achieved the threshold value of 0.5, through computing the average variance extracted (AVE). Accordingly, the composite reliability was assessed through computing the CR and its value and achieved the required threshold value of 0.6. Hence, the study has achieved the entire requirement for further analysis after performing the pooled-CFA. Accordingly, the findings suggest that employing the use of pooled-CFA procedure in dealing with studies of this nature with complexity in terms of items and constructs helps researchers in attaining suitable results.

CONCLUSION

The conclusion in this study is based on the findings. In relation to this, the study of employee competence in Nigerian Universal Basic Education system Administration (UBESA) as research subject applied the CFA analysis to evaluate the fitness of measurement model through the pooled-CFA using structural equation modeling technique with AMOS-24. The developed questionnaire has 88 items. The study concludes that, the CFA analysis is very useful in detecting the appropriateness of questionnaire intends to use for the study. Thus, all items have achieved the requirement in accordance with the proposed scales. In depending on CFA analysis, the current study highlighted the importance of applying the pooled CFA in a complex subject matter other than the ordinary CFA. The pooled CFA is no doubt the eased method of analysis for researchers/scholars in conducting research with complexity in terms of variables and items besides disposing them to better understanding of empirical study. Hence, this study is fitting to recommend to the readers at beginning stage to practice the pooled confirmatory factor analysis in dealing with empirical research especially when dealing with a complex subject matter.

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