The Confirmatory Factor Analysis (CFA) of Preschool Management Model in Sarawak

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Abstract: In several years, structural equation modeling or popularly known as SEM is the first generation path modeling widely used by researchers and practitioners nowadays to analyze the interrelationship among variables in a model. In this study, the questionnaire was designed based on six constructs which is headmaster's instructional leadership as exogenous and parental involvement in preschool education, preschool teachers' information and communication technology (ICT) in teaching, teacher professional development, and preschool development plans and effective teaching among preschool teachers are endogenous variable. The questionnaires were distributed to 280 preschool teachers in Sarawak. The total of 267 questionnaires were returned to researcher for the validity and reliability test in this study. The ultimate objective of this article is to acquire the best fit of a research instrument for the effective teaching study using structural equation model (SEM) that enable to taking into account the unreliable factors (items) between exogenous and endogenous constructs. The items of the constructs undergo the confirmatory factor analysis (CFA) procedure involve in unidimensionality test, convergent validity, construct validity and discriminant validity. The result revealed the constructs of the research model achieved the validity and reliability for other further analysis in acquiring high accuracy on the prediction outcomes.
Keywords: *AMOS, CFA,* Reliability, Validitity, Composite Reliavility (AR), Average Variance Extracted (AVE)

Introduction

In this study, the relationship between exogenous constructs such instructional leadership, parental involvement in preschool education, preschool teachers' information and communication technology (ICT) in teaching, teacher professional development, and preschool development plans and endogenous construct, namely effective teaching among preschool teachers will be assessed through a Preschool Management Model (PMM), which has been designed by researcher guided by the theories of quality management in the field of education. The ecological theory can be applied in preschools to produce first class human capital that will lead and manage the future organization. Generally, the main objective of this study is to explore the quality of preschool education plays a very important role in increasing the awareness of governments and parents to implement policies and programs for preschools.

Since this study observes 6 latent variables, researcher will use structural equation model (SEM) to multiple correlated the latent variables concurrently in one measurement model that enable to taking into account the unreliable factors (items) between exogenous and endogenous constructs. Therefore, this paper is to emphasize the validity and reliability of constructs involve in this study using confirmatory factor analysis (CFA). In fact, CFA offers more parsimonious clarifications and greater modeling flexibility to achieve the fitness of the measurement model in SEM. Six models should be applied which are identification model, specification model, estimation model, evaluation model and modification verification model (Zainudin, 2012), the researchers used the analysis of moments structures (AMOS) version 23 to confirm the validity and reliability of the measurement model.

First of all, the items were tested for idimensionality reliability before validation the constructs. The convergent validity and discriminant validity were undertaken to validate all constructs to ensure the consistency of the measurement model. The unidimensional, validity and reliability of measurement model construct were used to measure the constructs that could not be measured directly (Joreskog & Sorbom, 1993). To evaluate the fitness of measurement and structural model (Holmes, Coote & Cunningham, 2006) and Hair, Back, Babin and Rolph (2010) have suggested using, at least, three fit indexes, which are absolute fit, incremental fit and parsimonious fit for construct validity.

From the CFA results, the researcher needs to look for the Fitness Indexes for the measurement model, the factor loading for every item, and also the correlation between constructs. The Fitness Indexes reflect the Construct Validity, while the factor loading indicates the importance of the respective item in measuring its construct. The assessment for Construct Validity is made based on Fitness Indexes and is shown in Table 1.

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

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Name of category Comments	Name of index	Index value	
Absolute fit	RMSEA	0.064	The required Level is achieved
Incremental fit	CFI	0.947	The required Level is achieved
Parsimonious fit	Chisq/df	3.575	The required Level is achieved

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2.0   LITERATURE REVIEW

Instructional leadership of school headmasters plays an important role in providing education of the 21st century. In this study, it will be reviewed in terms of interaction, parenting practices, openness, acceptance, school assignments, learning facilities at home, open days, activities, and preschool programmes. This is supported by Lee and Green (2008) who says that parents are the most active environmental agents since a child is born, and it can affect a child's development. According to Ahmet (2012), parents are involved not just in school, but also at home in their children's education. The involvement of parents in the home and at school continuously correlated with academic achievement of children.

Preschool teachers' information and communication technologies in teaching refers to use of ICT in the early stages of children by exposing them to multimedia and computer. This encourages them to learn better, faster, and more efficient. Early childhood exposure to ICT can also help develop critical thinking, creativity, thus improving their skills (Ruslin Amir, Norzaini Azman & Ibrahim Komoo, 2010).

In this study, preschool teachers' professional development is a process for individuals, groups, and organizations to acquire more efficient and effective teaching and learning. In addition, Muijs and Reynolds (2011) says that it is a process that requires a long period of training involving theory as the basis of practice, codes of conduct of its own, and a high degree of autonomy so that the teaching profession can be labelled as a professional.

School development plan is an approach to organizing relevant information about the current state of preschool to the desired future state. It also allows teachers to set short-term and long-term goals and aspirations. Moreover, Crandall, Eiseman and Seashore (1986) says that the preschool development plan must be flexible and sensitive to the situation of local plans to improve the quality of preschool education.

According to Brown, Morehead and Smith (2008), effective teaching refers to teachers who can bring children to the learning outcomes of the past and teachers not only know the concept, but also need to apply the concept or practices in classes taught. This involves a structured teaching pattern in terms of organization and conscious classroom lesson content to produce high quality education.

Social learning theory proposed by Bandura (1989) emphasizes that a preschool teacher's behaviour is influenced by the environment through reinforcement and imitation learning, and the ways of preschool teachers' thinking can influence the quality of teaching in preschools. According to Bandura (1989), observing and imitating the behaviour and attitudes of others is an act of learning.   In statistics, confirmatory factor analysis (CFA) is a special form of factor analysis, most commonly used in social research (Kline, 2011). It is used to test whether measures of a construct are consistent with a researcher's understanding of the nature of the construct. As such, the objective of confirmatory factor analysis is to test whether the data fit a hypothesized measurement model. This hypothesized model is based on theory or previous analytic research (Preedy & Watson, 2009). CFA was first developed by Joreskog (1969) and has built upon and replace older methods of analyzing construct validity such as MTMM Matrix as described in Campbell and Fiske (1959).

In confirmatory factor analysis, the researcher first develops a hypothesis about what factors he believes are underlying the measures he has used and may impose constrains on the model based on these a priori hypotheses. By imposing these constraints, the researcher is forcing the model to be consistent with the theory. Model fit measures could then be obtained to assess how well the proposed model captured the covariance between all the items or measures in the model. If the constraints the researcher has imposed on the model are

inconsistent with sample data, then the results of statistical test of model fit will indicate a poor fit, and the model will be rejected. If the fit is poor, it may be due to some items measuring multiple factors. It might also be that some items within a factor are more related to each other than others.

3.0   METHODOLOGY

3.1   Population and Samples of Study

The target respondents are among the preschool teacher in Sarawak. In this study, they were randomly selected from Kuching, Bau, Simunjan, Padawan and Lundu. The samples were selected using the propositional stratified sampling technique since the target population is heterogeneous. They have to be stratified into homogenous groups to become similar characteristics (Zainudin, 2012).

3.2 The Measurement Instrument

The questionnaire is used as a primary survey instrument in collecting quantitative data in numerical form. The structure of the questionnaire was developed based on Preschool Management Model. The questions were adopted from valid and reliability source based on researcher's knowledge and working experience in preschool. The total of 36 questionnaires was answered and returned by the respondents who are representative of their school from selected state in Sarawak. These amounts of data are valid to be analysed.

4.0 DATA ANALYSIS

Before proceeds to the validity and reliability of the measurement model, the items firstly should be confirmed the unidimensional items of the measurement model. What CFA for every latent construct involves in the study was executed to confirm the first order unidimensional items in the measurement model. The threshold of the factor loading should be 0.6 and above (Zainudin, 2012). The items with factor loading low than threshold were deleted in order to achieve unidimensionality. The result of unidimensionality as showed in Table 2 shows the number of items in the second order was deleted where the factor loading below than threshold (0.6) in the first order.

In this study, unidimensionality is achieved when all measuring items have acceptable factor loading for the respective latent construct. The deletion should be made one item at a time with the lowest factor loading item to be deleted first. After an item is deleted, the research will run the new measurement model.

Table 2: Unidimensionality Result

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Construct	Number of items (1st Order)	Number of itmes (2nd Order)
Headmaster's Instructional Leadership (KI)	6	4
Parental Involvement in Preschool Education (PIB)	6	4
Preschool teachers' information and communication technology (ICT) in teaching (TMK)	6	4
Teacher professional development (PPG)	6	4
Preschool development plans (PPP)	6	4
Effective teaching among preschool teachers (PB)	6	4

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Refer to Table 2 above, the number of items for KI, PIB, TMK, PPG, PPP, and PB are maintained after second order. 2 items of KI (KI3 and KI5), PIB (PIB7 and PIB11), TMK (TMK13 and TMK17), PPG (PPG 19 and PPG20), PPP (PPP25 and PPP26), and PB (PB31 and PB36) were deleted due to less than 0.6 factor loading.

4.1   Validity

Both, endogenous and exogenous constructs were validated by three methods, which are convergent, construct and discriminant validity.

4.1.1   Convergent validity

The convergent validity is the first method of validation processes on measurement model. According to Kline (2011), convergent validity is a set of items in one construct are inter-correlation, at least, moderate in magnitude and is measured through average variance extracted (AVE) where the threshold is above >0.5 indicates a high convergent validity (Fornell & Larcker, 1981). Factor loading of each item at ≥ 0.6 considered high convergent validity (Hair et al., 2010).

4.1.2 Construct Validity

The construct validity on all construct of the measurement model as presented in Figure 1 below achieved the good fitness index with RMSEA = 0.080, CFI = 0.883, TLI = 0.876 and Chi-Square/df.

4.1.3 Discriminant Validity

The discriminant validity is to avoid any redundant items in the measurement model (Zainudin, 2012). The items should not be related are in reality not related. It involves the relationship between a latent construct and other constructs of a similar nature. Discriminant validity can be identified by comparing the variance shared by the average AVE between these two constructs (Bove, Pervan, Beatty & Shiu, 2009). The estimated correlations between constructs should not be greater than 0.85 (Kline, 2011).

4.2 Reliability

Reliability will assess through three criteria namely, internal reliability using Cronbach alpha with threshold 0.600 and above (Nunnally & Bernstein, 1994) calculated using SPSS. While construct reliability (CR) should be 0.6 and above and average variance extracted (AVE) should be greater than 0.5 using AMOS application. The result is shown in Table 3 as follow.

Table 3: The Composite Reliability (CR) and AVE for all constructs

Construct	Item	Factor Loading	CR (above 0.6)	AVE (above 0.5)
	KI1	0.82		
	KI2	0.87		
	KI3	0.80	0.927	0.679
KI	KI4	0.86		
	KI5	0.80		
	KI6	0.79		
	PIB1	0.71		
	PIB2	0.79		
PIB	PIB3	0.79	0.820	0.577
	PIB4	0.68		
	PIB5	deleted		
	PIB6	0.82		

TMK	TMK1	deleted		
	TMK2	0.69		
	TMK3	0.85	0.860	0.616
	TMK4	0.81		
	TMK5	deleted		
	TMK6	0.78		
PPG	PPG1	deleted		
	PPG2	0.66		
	PPG3	0.65	0.838	0.511
	PPG4	0.80		
	PPG5	0.82		
	PPG6	0.62		
PPP	PPP1	0.70		
	PPP2	0.63		
	PPP3	0.72	0.846	0.502
	PPP4	0.78		
	PPP5	0.73		
	PPP6	0.68		
PB	PB1	0.62		
	PB2	0.79		
	PB3	0.76	0.870	0.529
	PB4	0.78		
	PB5	0.70		
	PB6	0.70		

The results in Table 3 shows the Average Variance Extracted (AVE) and the value of Composite Reliability (CR) for all constructs exceed the threshold value of 0.5 and 0.6 respectively. Thus, the study concludes that the Convergent Validity and Composite Reliability for all constructs in the model have been achieved (Zainudin, 2012).

3.3 Modeling The Measurement For A Single Construct

Confirmatory Factor Analysis (CFA) is a special form of factor analysis. It is employed to test whether the measures of a construct are consistent with the researcher's understanding of the nature of the construct. The CFA procedure replaced the older methods to determine construct validity. Every measurement model of a latent construct needs to undergo CFA before modeling in SEM.

In this study, the researcher run AMOS to calculate the standardized estimate and squared multiple correlations by clicking the respective box in the analysis menu. The standardized estimate indicate the factor loading for each item in a measurement model. Any item having loading less than 0.6 and R^2 less than 0.4 should be deleted from the measurement model. An item having low factor loading simply means that particular item is deemed useless to measure that particular construct. Keeping useless item in a model will affect the fitness index of the model.

Table 4: Fit Indexes for the Constructs

Constructs	Absolute Fit RMSEA (<0.08)	Incremental fit fit GFI (>0.90)	Parsimonious fit CFI (>0.90)	Chi Square /df (<5.0)	Comments
KI	.073	.991	.996	2.410	Achieved
PIB	.000	.998	1.00	0.483	Achieved
TMK	.006	.992	.995	2.228	Achieved
PPG	.076	.991	.992	2.544	Achieved
PPP	.043	.995	.997	1.497	Achieved
PB	.079	.996	1.00	1.015	Achieved

5.0   DISCUSSION

As a research instrument, the questionnaire should go through the validation process to ensure its validity and reliability of the items involve for the accurate and reliable findings of the study. The validity and reliability of constructs of the study which are headmaster's leadership, parental involvement in preschool education, preschool teachers' information and communication technology (ICT) in teaching, teacher professional development, and preschool development plans and effective teaching among preschool teachers were measured using CFA with AMOS 23. Only the items of the constructs with factor loading >0.60 remain in the measurement model after the unidimensionality process. Afterward, the AVE of the remain

constructs was calculated with the threshold above >0.5 achieve the convergent validity (Fornell & Larcker, 1981). Together with a factor loading of all items ≥ 0.6 are considered high convergent validity (Hair et al., 2010). Later, the construct validity are measured with good fitness index on the measurement model with RMSEA = 0.080, CFI = 0.883, TLI = 0.876 and Chi-Square/df = 3.270. Furthermore, the measurement model was run for the discriminant validity to confirm no redundancy of the constructs. The measurement of this study achieves the discriminant validity where the correlations between constructs are < 0.85 (Kline, 2011). All the construct of the study achieved threshold's validity and reliability for further correlation measurement of the research model.

6.0   CONCLUSION

The constructs of the study must undergo the validity and reliability process to confirm the unidimensional of its items in the measurement model as the research model of the study. All construct was correlated to each other in the form of structural equation model (SEM) as a measurement model to test factor loading of the 36 items. CFA procedures consist of unidimensionality, convergent validity, construct validity and discriminant validity.

It is important to ensure all the constructs involve achieved the validity and reliability before proceeding to the next measurement of relationship, moderation and mediation. Fail to achieve the validity and reliability will lead to error and inaccurate statistical results. Thus, the findings of the study will totally insignificant.

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