

DEVELOPMENT OF FOUR PHASED AUTOMOBILE TRANSMISSION SYSTEMS CONCEPTUAL INSTRUCTIONAL MODEL FOR ACADEMIA

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ABSTRACT

Several conceptual methods were proposed in literature for instructional strategies. However, only few can be considered reliable in terms of Automobile instructions. In this article, a new model; Four Phased Conceptual model is proposed for automobile transmission systems. The model is a related structure or a framework that represents a system to serve as a method for the instruction. It comprises of four inter-phased structural models of GBX, CLH, PSH and AXD transmission systems. It served pictorially for the respondents and aided their visualized knowledge to the AE topic taught for this research. Map (L1) instructional method and its scoring system and researcher developed questionnaire was used for data collection. The model was conventionally developed based on the transmission systems items that proved more important amongst other items such as: GBX1, GBX2, GBX3, GBX4, GBX5, and GBX7, CLH1, CLH5, CLH6, CLH7, CLH8, PLS1, PLS2, PLS3, PLS5, PLS6 and PLS2, ADX3, AXD4, AXD5, AXD6 for gear box, clutch, propeller shaft and axle drive transmission systems respectively inter-phased in the structural instructional model. These were established through SEM after thorough modification via AMOS. The model, after evaluation on the AE respondents showed significant performance results with the post test scores of 152.472 and 153.472 as against 59.209 of pretest score.

Keywords: Concept Map, Questionnaire, AMOS, SEM, Transmission Systems

1 INTRODUCTION

Comprehensive knowledge through learning is facilitated by a successful tentative training through accomplishments by having direct memory of the learner's intelligent change. Investigation has proven that Automobile Engineering (AE) amongst other disciplines requires hand on desk task by employers. The Four-phased conceptual model in this framework is an interphase of Automobile Transmission Systems (ATS) of Gearbox (GBX), Clutch (CLH), Propeller Shaft (PLS) and Axle Drive (AXD) systems. Generally, the world has been changed into an economy nation-state, therefore, employers of labour needs knowledgeable/skilful graduates to fit for profitable and greater development of their industry requirements. The significant setback accordingly, postured thoughtful responsibilities to educational organisations. Well-informed and established economy employees are presumed to have sound and prepared skills from higher re-known institutes for the labour force. Globally, for greater development, tertiary institutions are tasked with the responsibilities of training all types of skills required by employers as a societal obligation both inside and outside the organizations, and concurrently seek prospect for graduates to contribute in an informative event appropriate for the changing world [1]. It's therefore, for these as approved that, it is the responsibilities of the higher institutional bodies to produce and transform novel concepts, techniques and products for the changing world into monetary wealth [2]. Therefore, with no much accepted and viable conceptual

instructional model found in the literature that enhanced automobile graduates' evaluation, developing four phased conceptual instructional model could serve more significant. Suggestions with the aforementioned needs for improvement from the classroom through the academics, AE as a discipline is one of the most significant, economic, societal and for industrial growth, should be endeavour to deliver feasible prospects of transforming the operational structures of training for the skills acquisition. This marvel is to prepare the graduates to arrive at a modest global work opportunity. This according to [2], the graduate's academic and proficiency attainments have always been disputed of amongst the scholars in meeting the knowledge circumstances of the measures. But with hands on desk through the four phased conceptual instructional model, there would be attainment of qualified automobile graduates.

2 MEHODOLOGY

CMap (L1) as the instructional method for data collection and its scoring system was adopted. Structural Equation Modelling (SEM) technique was explicitly used in developing the model and for analysing the paramount sizes of the transmission systems items, and were re-modified through Analysis of Moment of Structure (AMOS). On scrutiny, the items with their factors communally were clearly itemised by [3] method. Additionally, the structure of the factors regulated using AMOS to determine the model width, likewise to check the fitness of the model to the data according to [4]. While enveloping the model, the parametric evaluation was first evaluated by multiple regression analysis (R^2), subsequently the model fit. On evaluating the incorrect model fit values, modification indices, standardized residuals, regression weights system was employed. According to this scholar, the standardized residuals values must be lesser than 2.0 in absolute value for correlation models. Supplementary, covariance and multivariate normal distributions were some of the indicators that affected the model fitness presentation, but during the SEM analysis, the multivariates normality distribution of the observed variables were presumed as standardised distributions. Altogether, the sample were measured as multivariate distributed at 0.05 level of significance with the critical ratios smaller than 1.96. According to [5], with regard to learning from different domains, the coefficient of multivariate kurtosis is not supposed to be significantly different with zero and the multivariate Kurtosis be greater and the multivariate non-normality remains at extreme (critical ratio >1.96) even if univariate skewness and/or Kurtosis normally varies between -1.00 to +1.00. As the critical value ratio > 1.96 , various multivariates were included in the model, and needed not to be used as the standard recommended values [3, 6]. The adjusted significant model that satisfied the fitness well from the data established based on the default indices were used to developing the model. Data were collected from three geopolitical zones of Nigeria (North-East), Adamawa, Bauchi, and Borno States Federal institutions that offers AE courses shown in Table 1.

Table 1. Institutions That Offers Automobile Engineering Courses in the North-East Region

Name of Institution	Location
Abubakar Tafawa Balewa University	Bauchi, Bauchi State
Modibbo Adama University, Yola	Yola, Adamawa State
University of Maiduguri	Maiduguri, Borno State

Table 2 is the questionnaire used for evaluating students' academic performances at (B. Eng.) and (B. Tech. Eng.) in Automobile Transmission Systems (ATS) on the concepts of GBX, CLH, PLS and AXD, while Table 3 was used to construct Concept Map (CMap) in Figure.1 of the four transmission systems with the arbitrarily arranged items.

Table 2. GBX, CLH, PSH and AXD Items Considered Significant

S/No.	GBX	CLH	PSH	AXD
1	GBX1	CLH1	PSH1	AXD2
2	GBX2	CLH5	PSH2	AXD3
3	GBX3	CLH6	PSH3	AXD4
4	GBX4	CLH7	PSH5	AXD5
5	GBX5	CLH8	PSH6	AXD6
6	GBX7			

Table 3. CMapping of GBX, CLH, PSH and ADX, as transmission systems

GBX	CLH	PSH	AXD
Driven gears	Mounted on	Connect 1	Connect
Driving gears	Pressure plate	Spider	Inboard joint tulip
Spur gears	Clutch disc	Spider bearing	Axle hub
Helical gears	Mount on	Spider ring	Tripod spider
Connect	Flywheel	Connect 2	Attached to
Parallel shafts	Connect 1	Connect 3	Has
Non-intersection shafts	Consist 1	Final drive	
Example 1	Consist 2	Connect 4	
Examples 2	Connect 2		

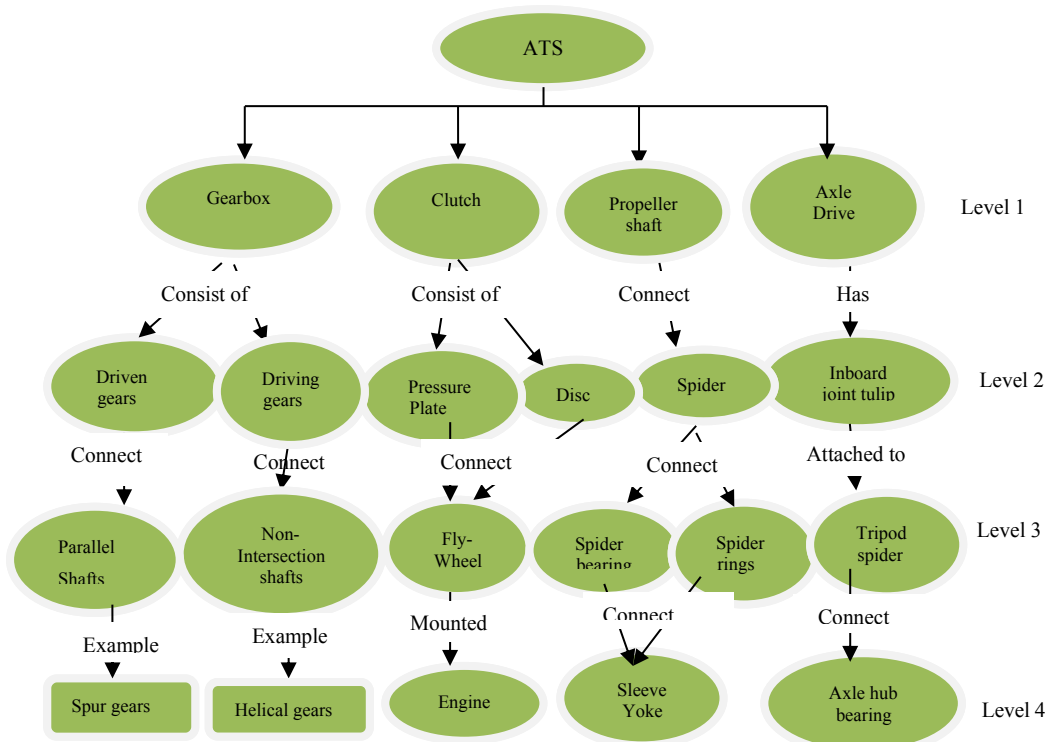


Figure 1. CMAP Assessment Test Scoring Procedure

3 RESULTS AND DISCUSSION

Table 4(a) shows the model fit parameters that satisfied the goodness of fit indices of GBX, CLH, PSH AND AXD systems generated and accepted based on the respondent results, while Table 4(b) shows the default model fit parameters that satisfied the goodness of fit indices of the systems on which Table 4(a) was accepted.

Table 4(a). Modified Measurement Model Fit Indices of GBX, CLH, PSH and AXD

Model Fit Indices	Computed Values				Range Values (P)
	GBX	CLH	PSH	AXD	
Chi-square (χ^2)/df	2.65	2.45	2.86	1.52	< 3.00
Goodness of Fit (GFI)	0.95	0.95	0.97	0.99	≥ 0.90
Tucker-Lewis Index (TLI)	0.91	0.93	0.92	0.97	≥ 0.90
Comparative Fit Index (CFI)	0.93	0.95	0.96	0.99	≥ 0.90
Incremental Fit Index (IFI)	0.94	0.95	0.96	0.97	≥ 0.90
Root Mean Square Residual (RMR)	0.02	0.02	0.02	0.02	≤ 0.05
Root Mean Square Error of Approximation (RMSEA)	0.04	0	0.04	0.04	≤ 0.05

Table 4(b). Default Model Fit Evaluation Indices [4]

Model Fit Indices	Range Values P	
Chi Square (χ^2)/df	< 0.30	
Goodness of Fit (GFI)	≥ 0.90	
Incremental Fit Index (IFI)	≥ 0.90	0.00
Tucker-Lewis Index (TLI)	≥ 0.90	
Comparative Fit Index (CFI)	≥ 0.90	
Root Mean Square Residual (RMSR)	≤ 0.05	
Root Mean Square Error of Approximation (RMSEA)	≥ 0.05	

The discriminate validity of the ATS concepts used was obtained through series of test analysis that required pairs of individual unobserved constructs to be correlated and uncorrelated to each other. Table 5 and Figure 2 represent six related pairs in which the chi-square values of the unconstraint measurement models were greater than the constraint measurement models. It was proven that the items which represented GBX, CLH, PSH and AXD were discriminate to each other.

Table 5. Discriminate Validity of ATS Concepts

Pair wises	Unconstraint (Initial)			Constraint (Modified)		
	Chi-square	Df	P	Chi-square	df	P
GBX – CLH	220.548	103	.000	121.111	53	.000
GBX – PSH	197.213	76	.000	122.780	43	.000
GBX – AXD	123.613	76	.001	112.930	43	.000
CLH – PSH	160.833	76	.000	94.023	43	.001
CLH – AXD	185.232	76	.000	111.235	43	.000
PSH – AXD	138.364	53	.000	87.000	34	.003

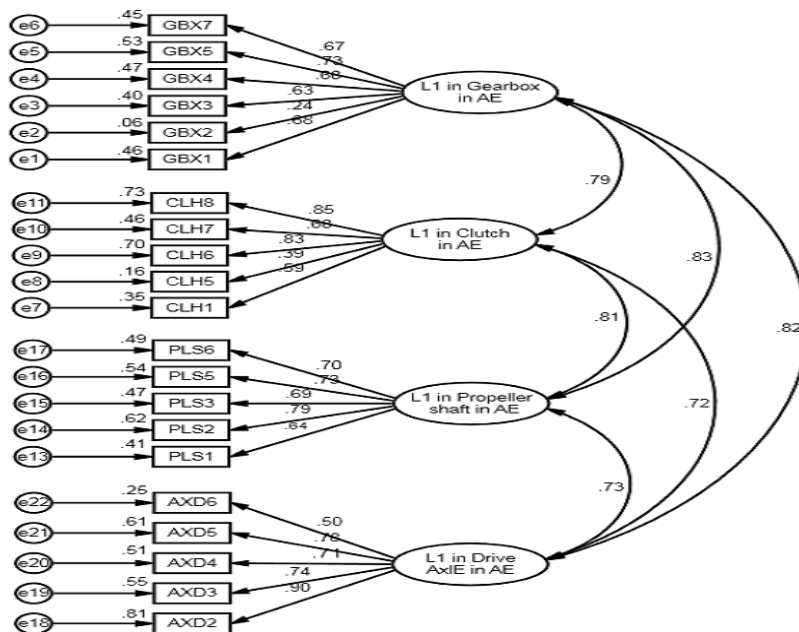


Figure 2. Discriminate Analysis of Modified ATS Concepts

The general finding of the research in Figure 3 shows that the post-test mean score plot analysis results of the experimental and the control groups indicates that the mean scores of the respondents' academic achievement in Control (L1) group and experimental (LE) groups are approximately 59.209, 152.472, and 153.472 respectively higher than those found in literature. It has clearly showed that there is significant effects of the independent variables L1 on the dependent variable (respondents' academic achievements) with the post-test mean values of 152.472 and 153.472 respectively compared to the Control group with 59.209.

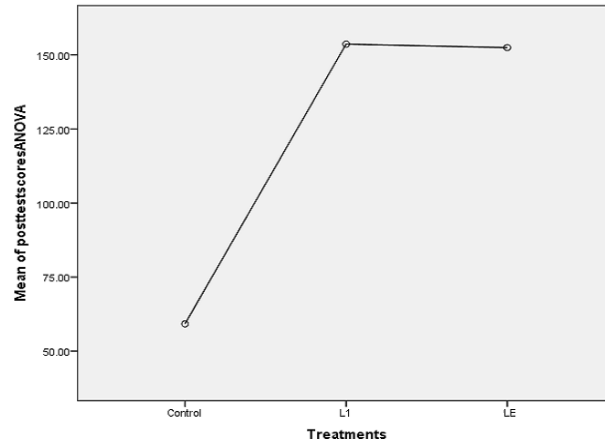


Figure 3. Post-test Means Plots Analysis Results of the Experimental and Controlled Group using CMAP Method

GBX, CLH, PSH and AXD are the four phased conceptual instructional model of the research with six, five, five and five items each was developed and pictorial drawn in Figure 4. Table 4(b) above shows the default Model Fit Evaluation Indices used in developing the standard model as specified by notable scholars [4]. After redressing the transmission system items by SEM via AMOS, Table 4(a) shows the computed values of the four model fit indices that met the default model fit evaluation indices in Table 4(b) and finally the structural model of the ATS Figure 4.

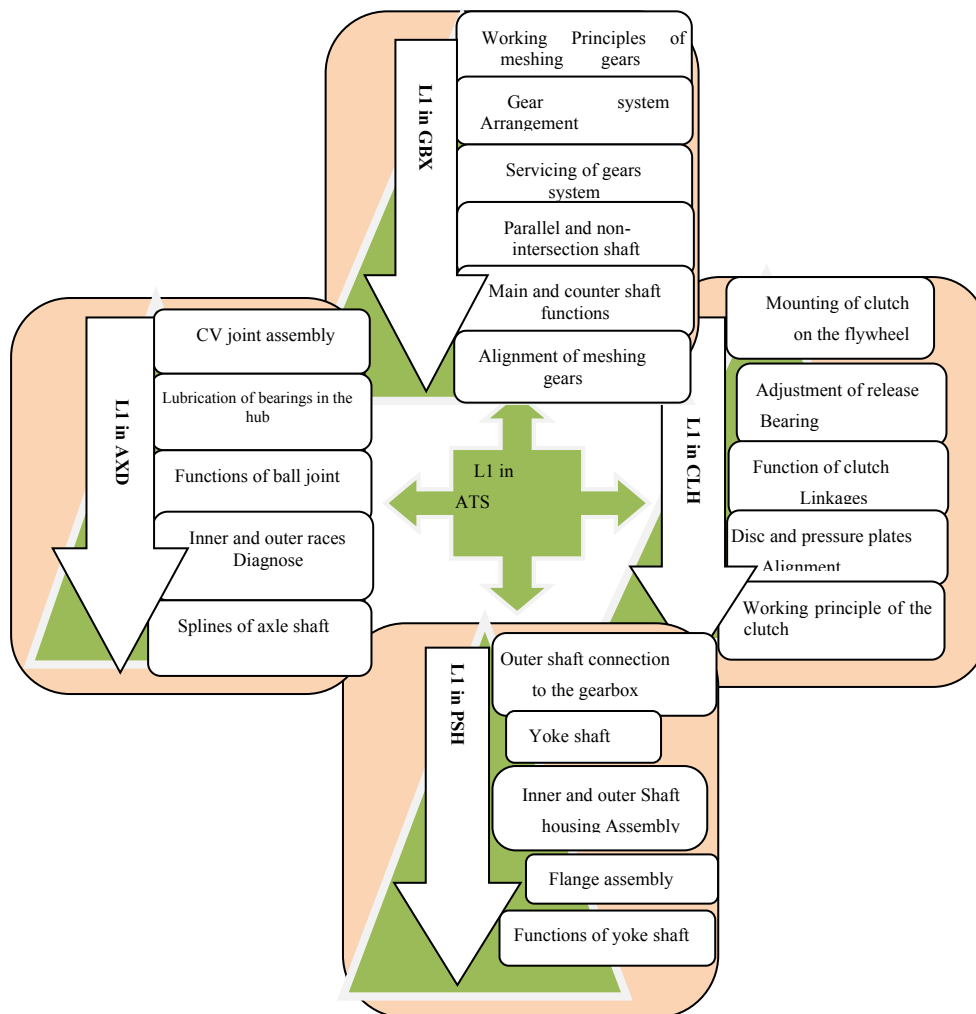


Figure 4. Structural Conceptual Instructional Model of GBX, CLH, PSH and AXD Systems

4 CONCLUSIONS

The model was developed by SEM via AMOS using the modified ATS items. The model data was confirmed fit based on the default model fit evaluation indices values during instruction in AE on ATS systems. Considering the motives of the 21st century, the model fits best for maximum achievement in AE course required by labour force. CMAP used for data demonstrated a successful instruction method for rising students' performances easily. The four phased model could be modified by using different courses across tertiary institutions prospectus in Nigeria.

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