

DEVELOPMENT OF AUTOMOBILE AXLE DRIVE TRANSMISSION SYSTEM CONCEPTUAL MODEL

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ABSTRACT

Several conceptual knowledge assimilation methods were suggested in literature, but nonetheless, few could be considered reliable in Automobile Engineering concepts especially of the transmission systems. Therefore, in this work, a new conceptual model is proposed for the system. It describes the development of the Axle Drive (AXD) of Automobile transmission system for scholars perceptions to enhancing indispensable assimilation of captivations. It was developed base on the items considered most significantly important amongst other items by systematic analysis through Structural Equation Modelling (SEM) via Analysis of Moment of Structure (AMOS). The techniques used were the concept mapping assessment experimental structure and the researcher developed structural analysis. The most acceptable and preferred items used for the model development are: AXD1 (Functions of bearing types), ADX2 (CV joint assembly), AXD3 (Lubrication of bearings in the hub), AXD4 (Ball join functions), AXD5 (Inner and outer races diagnose) and AXD6 (Splines of axle shaft) of the transmission system. The model developed established that the scholars concerts as presented by the pictorial model showed expressive perfection on the Automobile Engineering (AE) intellects. The model could be modified using diverse engineering courses, likewise any other course in Nigerian Tertiary institutions.

Keywords: Concept Mapping, Structural Analysis, AMOS, SEM, AXD

1 INTRODUCTION

Perception of skill knowledge through learning is facilitated through a successful and or tentative training through accomplishments having direct memory of the learner's intelligent change. Investigational searches have proven to be very important in Automobile Engineering (AE) from the beginning to the present time. This emphasis the major reason why employers of labour, government or private require knowledgeable graduates from distinguish institutes that are fully trained for greater contributions to the development of the general public. Axle drive model is a concept in this framework that denotes the transmission system chosen for the article. Nowadays, the world generally has changed into an economy nation-state. That is the reason why generally, employers of labour needs well proficient graduates that are fit for the development of their labour needs. This substantial swing consequently, posed serious tasks to educational bodies. Knowledgeable based economy personnel is assumed to have a sound and prepared skill from a higher re-known institution for labour force. Additionally, tertiary institutions are with the greater tasks to reinforce training of individuals and with the societal obligations both inside and outside the organizations, and concurrently seek prospect for graduates to contribute in informative events relevant in the changing world [1]. It's thus, approved that it is the responsibilities, capacity and ability of the higher institutional bodies to produce and transform graduate through novel concepts, techniques and products for changing these into monetary value. Suggestion with the aforementioned need for

improvement in AE as one of the most economic, societal and industrial growth that should be endeavoured to deliver feasible prospects to transform the operational structures of training for skill acquisition. This phenomenon is to prepare the graduates to arrive at a modest global work opportunities. This is because graduate's academic and proficiency attainments have always been disputed of amongst the scholars by the employers in meeting the knowledge circumstances of these measures [2], therefore, it becomes necessary for the development of the Axle Drive (AXD) of Automobile transmission system for scholars perceptions to enhancing indispensable assimilation of captivations in the existing century.

2 MATERIALS AND METHODS

In developing the model, Structural Equation Modelling (SEM) technique was explicitly used in analysing the paramount size of the shaft (drive axle) items and were re-modified through Analysis of Moment of Structure (AMOS). In scrutiny of the items mutually, the factors with their indicators were clearly itemised using Kline method [3]. In addition, AMOS was further used to regulate the structure of the factors in the width of the model likewise to check the model fitness to the data Lacobucci, [4]. In developing the model, the parametric evaluation was first evaluated that is; the multiple regression analysis (R^2), thereafter the model fit [5]. During analysis of incorrect model fit values, the modification indices, the standardized residuals, regression weights according to [6] were observed. Based on these scholars' findings, the value of standardized residuals must be smaller than 2.0 in absolute value for correlation models. Furthermore, there were some additional indicators that affected the fitness presentation of the anticipated model. These are covariances and multivariate normal distributions. During the SEM analysis, the multivariate normality distribution of the observed variables were assumed as standardised distributions. All samples were normally measured as multivariate distributed at 0.05 level of significance with the critical ratios less than 1.96. According to [7], it indicates the coefficient of multivariate kurtosis not significantly different when zero. Conversely, the multivariate Kurtosis be able to be greater and the multivariate non-normality were at extreme (critical ratio >1.96) even if univariate skewness and/or Kurtosis normally varies between (-1.00 to +1.00) [8] as obtained mostly from the variables. Due to the critical value ratio (1.96), various multivariate were included in the model, and were not used as the standard recommended values [9] and [10]. Consequently, modified measurement model that fulfilled the fit well from the data established on the default indices were careful proffered for developing the model.

2.1 The Study Area

This article was established using the data gathered from the three States of the geopolitical zone of Nigeria (North-East) Figure 1, namely Adamawa, Bauchi, and Borno States Federal institutions that offers AE courses indicated in Table 1.

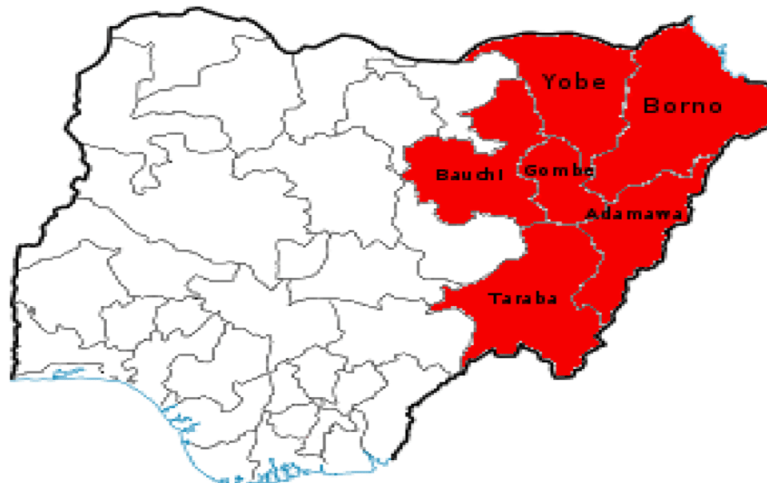


Figure 1. Mapp of Nigeria Showing the Six Geo- Political States

Table 1. Institutions That Offers (AE) Courses in the North-East Region

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

Table 2 presents the survey used for evaluating the respondents' performances in (B. Eng.) and (B. Tec. Eng.) in Automobile Transmission Systems (ATS) on the concepts of the Axle Drive on a 5 point scale such that: A = 4; B = 3; C = 2; D = 1; E = 0. It was computed based on the equivalent grading system of the Federal Ministry of Education (FME, 2012) Nigeria, while the 5 point scale survey responses was calibrated as: 1 = Not Important (NI); 2 = Less Important (LSI); 3 = Little Important (LI); 4 = Very Important (VI); and 5 = Highly Important (HI). Table 3 was used to construct Concept Map (CMap), Figure 2 is the indiscriminately arranged AXD transmission system items.

Table 2. AXD Items Considered As:

S/N.	Items	NI (1)	LSI (2)	LI (3)	VI (4)	HI (5)
1	CV joint assembly					
2	Axle shaft rotation principle					
3	Lubrication of bearings in the hub					
4	Ball joint functions					
5	Connection of axle to the hub					
6	Functions of bearing types					
7	linkages systems					
8	Splines of axle shaft					
9	Inner and outer races diagnose					
10	Tulip assembly					

Table 3. What Do You Understand about AXD as a Transmission System by C.Mapping?

1		Connect
2		Inboard joint tulip
3		Axle hub bearing
4	AXD	Tripod spider
5		Attached to
6		Has

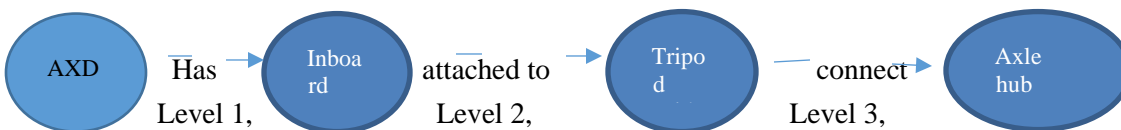


Figure 2. Concept Mapping Structure of AXD Transmission System

3 RESULT AND DISCUSSION

The result in Table 4 shows the model fit parameters that satisfied the goodness of fit indices with 1.52 for (χ^2)/df, GFI (0.99), TLI (0.97), CFI (0.99), IFI (0.97), RMR (0.02) and RMSEA (0.04) at $P < .05$. The hypothesis which states that: there is “No” significant relationship between areas considered important on the concept of AXD for effective instruction in AE in Nigerian tertiary institutions offering AE courses was hereby rejected, and the structural model in Figure 3 was generated and accepted based on the respondent results.

Table 4. Modified Measurement Model Fit Indices of AXD

Model Fit Indices	Computed values	Range Values	P
Chi-square (χ^2)/df	1.52	< 3.00	
Goodness of Fit (GFI)	0.99	≥ 0.90	
Tucker-Lewis Index (TLI)	0.97	≥ 0.90	
Comparative Fit Index (CFI)	0.99	≥ 0.90	.000
Incremental Fit Index (IFI)	0.97	≥ 0.90	
Root Mean Square Residual (RMR)	0.02	≤ 0.05	
Root Mean Square Error of Approximation (RMSEA)	0.04	≤ 0.05	

AXD model as the theme of the research during SLR analysis of the items, the result was further redressed using AMOS out of which six of the items were finally used to improve the model. Table 5 shows the default model fit estimation parameters used in developing the model as specified by notable scholars

Table 5. Default Model Fit Evaluation Indices

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	
Tucker-Lewis Index (TLI)	≥ 0.90	.000
Comparative Fit Index (CFI)	≥ 0.90	
Root Mean Square Residual (RMSR)	≤ 0.05	
Root Mean Square Error of Approximation (RMSEA)	≥ 0.05	

After redressing the AXD items by SEM via AMOS, Table 4 above shows the computed values of the AXD model fit indices that meets the default model fit evaluation indices in Table 5 and finally the SEM of the AXD Figure 3.

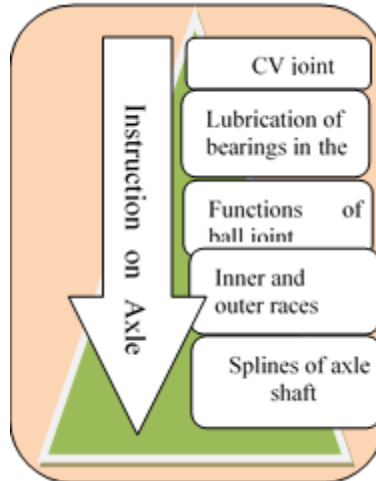


Figure 3. SEM of AXD

Figure3 is the model structure of the significant relationship between the five areas considered most important on the aspect of AXD for effective integration and analysis of scholars instructions denoted as (L1) in AE through SEM via AMOS. Therefore, from the modified measurement model the fit indices in Table 6, it shows the five important areas AXD2 (CV joint assembly), AXD3 (lubrication of bearings in the hub), AXD4 (functions of ball joints), AXD5 (inner and outer races diagnose), and AXD6 (splines of axle shaft) with the corresponding modified model structure considered significant, and that enhances pictorial vision of scholars academic capture compared to that ordinary visionaries.

Table 6. Modified Measurement Model Fit Indices of L1 Integration in Axle Drive

Model Fit Indices	Computed values	Range Values	P
Chi-square (χ^2)/df	1.52	< 3.00	
Goodness of Fit (GFI)	0.99	≥ 0.90	
Tucker-Lewis Index (TLI)	0.97	≥ 0.90	
Comparative Fit Index (CFI)	0.99	≥ 0.90	
Incremental Fit Index (IFI)	0.97	≥ 0.90	000
Root Mean Square Residual (RMR)	0.02	≤ 0.05	
Root Mean Square Error of Approximation (RMSEA)	0.04	≤ 0.05	

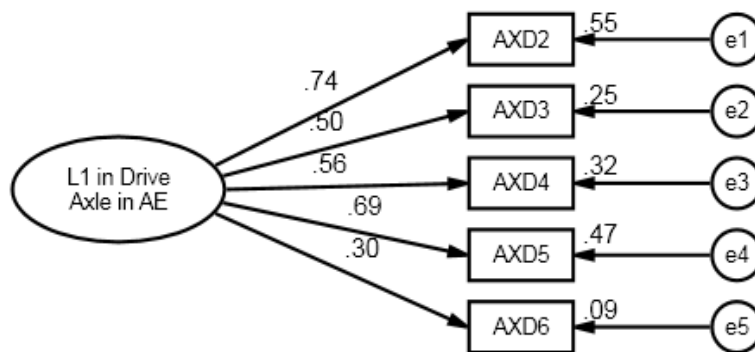


Figure 4. Modified model structural of AXD

4 CONCLUSIONS

The model was developed by SEM via AMOS using the modified AXD items. Data collected were confirmed fit the model based on the default model fit evaluation indices values during instruction in AE. Considering the objective of the 21st century, the model fits best for maximum accomplishment in AE course for skill development in tertiary institutions required by labour force. Concept mapping as anode through which the data was collected demonstrated a successful instruction method for rising scholars performances through easy understanding

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