



Competency Training Needs of Polytechnic Pre-Service Technicians for Diagnosis and Repairs of Modern Automobiles in Northern Nigeria

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ABSTRACT

The main purpose of this study was to determine competency training needs of polytechnic Pre-service technicians for diagnosis and repairs of modern automobiles in Northern Nigeria. The study sought to answer four research questions using Competency Outcome Performance Assessment (COPA) model framework. It is paramount importance to note that competency training needs of diagnosis and repairs of modern cars requires practical and effective training skills to be able to adequately repair them. A descriptive survey research design was adopted for the study. The population for the study was made up of 384 technicians in automotive technology in the NBTE accredited polytechnics in Northern Nigeria. Out of 384 a sample of 192 was randomly selected for the study. The questionnaire consisted of 192 tasks on diagnosis and repairs skills needed, developed with reference to curriculum of National Automobile Technician Education (NATE) and National Vocational Certificate in Automotive / Mechatronics approved by National Board for Technical Education. The questionnaire was divided into two sections: A & B, Section A contains items designed to obtain personal information of the respondents, while section B is divided into four sub-sections (I, II, III & IV). The instrument was developed using COPA Model structure, adapted from Lenburge et al (2009). A four-point rating scale ranges from Highly Needed (HN) = 4, Needed (N) = 3, Moderately Needed (MN) = 2, Least Needed (LN) = 1 was employed in sub-section I, while four-point rating scaled ranges from most relevant (4), highly relevant (3), moderately relevant (2) and less relevant. Data generated from the use of the questionnaire was analyzed with Statistical Package for Social Sciences (SPSS) 23rd version software using mean and standard deviation to answer the research questions. Findings revealed that Competencies in Basic Electronics and Technology of modern Automotive are essentially needed in the training of polytechnic Pre-service Technicians in diagnosis and repairs of modern Automobiles. Based on the findings of the study, appropriate recommendations were made, among which is, that the identified essential competencies will help lecturers in developing lesson plan using the competencies that are essentially needed by Pre-service automotive technicians in order for them to prepare on how to teach them appropriately.

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I. Introduction

Over the years number of jobs has been disappearing while some are coming into being. Today's workforce is witnessing a lot of changes from manufacturing to the computer information era which resulted into the incorporation of integrated electronic system and computer technologies in modern vehicles (Jalal, 2009). There has been a movement away from such traditional methods (trial and error) of repair of automobiles

to modern procedures. To meet-up with some of these great challenges needed by the world of work today; automobile technology must respond appropriately to various changes taking place and remain relevant in preparing individuals that would be able to take advantage of the opportunities created by modern technology. In essence, the technicians training at the polytechnic level are expected to remain current with the recent technologies and be adaptable to the changes in the workforce and be familiar with the tools needed to enhance their adaptability to the changes. It is noticed that majority of graduate of automobile technicians product in Nigeria lack the requisite knowledge and skills on how to go about diagnosing and repair of modern automobile (Jalal, 2013). In fact, this trend would render them irrelevant in their job places.

The main objective of polytechnic education is the promotion of technical and vocational education as well as training, technology transfer as a well skills development to enhance the socio-economy advancement of the country. For decades educational sectors has recognized that skills training is decreasing in our polytechnic education system as students tend to be more exposed to rote learning than the competency to operate positively in the labour market. Modern automobile are a blend of 20th century and 21st century technology. The designs of modern cars have advanced to a very sophisticated level. Unlike the old mechanically operated vehicle systems, the modern cars are being operated and controlled by a computerized electrical sensors indeed, almost every other function within the engine is controlled by an on-board computer (Akinola, 2015) Brain Box System. Yakubu (2011) have also observed that, to prepare technicians in automobile technology, the curriculum need to provide students with requisite skills necessary for industrial demands in automobile repairs and maintenance. Thus, a gap created by the anomaly which lead to question on the effectiveness of current training in automobile technology programmes in Nigerian Polytechnics. These developments call for an up-date on the way training of automobile technicians in Polytechnics is being conducted.

Polytechnics programmes need to be reviewed regularly in line with the changes that are taking place in industries. The researcher interested and motivated to used COPA Model framework to promote competence in the teaching of modern automotive practice. It is based on the philosophy of competence-based practice-oriented methods and outcomes and is organized around four essential conceptual pillars.

Statement of the Problem

Polytechnic education is the bedrock of development, is faced with a myriad of challenges, and training, the United Nations Educational, Scientific, and Cultural Organisation's (UNESCO) recommended 26 per cent of the national budgets to educational sector despite that education has been very low, hindering effective teaching and learning (Usman, 2015). In Nigerian education system, the background level of the programmes for education and training of craft men and master craft men for the maintenance of motor vehicles are carried out in technical colleges at National Technical Certificate (NTC) in addition to that, Intermediate Technical Certificate (ITC) and Advance National Technical Certificate (ANTC) is a certificate course offered at the polytechnic respectively. A one (1) year programme meant to take care of those that cannot be admitted into National Diploma ND levels (NBTE, 2013). However, a study conducted by (Odigiri, 2010) have revealed that the products of the NTC, ITC and ANTC programmes lacked the basic skills needed for gainful employment in present day automotive industries. The nature of the training is often blamed on inadequacy and irrelevant skills needed to meet the challenges in the maintenance of modern automotive.

It is a common knowledge that a large proportions of automobile technicians, both the experience and trainees in Nigeria find it extremely difficult to diagnose, repair and maintain modern cars (Akinola and Ogedenga, 2011). As a result of this development in Automobile Technology industries, modern vehicle were produced with more sensitive components such as Brain Box which cannot detect faults by trial and error rather with digital diagnostic instruments (Tijjani, 2013). This might be the reason why most of our Automobile Technicians train with the old system find it extremely difficult to repair and maintain the modern vehicles through diagnostic instruments that could be attributed to reasons such as waste of time in detecting faults, damage to engine without the use of diagnostic tools and lack of appropriate maintenance practices (Agyapung, 2014).

Furthermore, skill gap analysis conducted by the National Automotive Council (NAC) of Nigeria in 2014 revealed that much is needed for the training of automobile service technicians as majority of them lacked the skills and equipment to properly maintain modern vehicles (Jalal, 2009). This calls for reason and justification of such a study to be conducted to identify competencies and skill needs of the technicians programmes of polytechnic reviews.

Objectives of the Study

The main objectives of the study was to determine the competency training needs of polytechnic Pre-service automotive technicians using competency outcome performance assessment (COPA) model approach as a guide. Specifically, the study sought to: -

1. Identify the essential competencies needed by polytechnic Pre-service technician for diagnosis and repairs of modern automobiles in northern Nigerian.
2. Determine the most relevant outcome statements that integrate the competencies needed by polytechnic Pre-service technicians for diagnosis and repairs of modern automobiles in northern Nigerian.
3. Find out whether the most relevant interactive learning strategies are linked to the outcome statements that integrates those competencies needed for diagnosis and repair of the modern automobile in northern Nigeria.
4. Establish weather the most relevant performance evaluation methods are utilize to validate achievement of outcomes of the competencies needed for diagnosis and repair of modern automobile in northern Nigeria.

Research Questions

The following research questions were formulated to guide the study:

1. What are the essential competencies needed by Polytechnic Pre-service Technicians for diagnosis and repair of Modern Automobiles in Northern Nigeria?
2. What are the relevant outcome statements that integrate the competencies needed by Polytechnic Pre-service Technicians for diagnosis and repair of Modern Automobile in Northern Nigeria?
3. What are the relevant interactive learning strategies that are link to the outcome statement needed for diagnosis and repair of Modern Automobiles in Northern Nigeria?
4. What are the most performance evaluation methods that are used to validate achievement needed for diagnosis and repairs of Modern Automobile in Northern Nigeria?

II. Methodology

The design of the study was a descriptive survey which served to answer the questions and the purposes of the study. The survey research is one in which a group of people or items is studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group. The geographical area of the study was Northern Nigeria.

The target population for the study was defined to include all technologists in the area of automotive technology in both state and federal Polytechnics in Nigerian, while the accessible population is the technologist within the researcher's reach. In this study the accessible population comprised of 384 technologists in the 21 polytechnics in Northern Nigerian.(NBTE, 2014). A purposive sampling technique was used to select 15 out of the 19 states offering automotive technology in respective of their proprietorship. A total of 192 technologist were sampled as part of the study out of the population of 384 using (Kregcie and Morgan, 1970) method of sampling techniques and a stratified proportionate random sampling using three cluster such as North - East, North – West and North – Central sampling method of the schools that were involve in the study **Source:** - NBTE (2014).

The instrument for data collection was a structured questionnaire titled: Competency Needs of Automobile Polytechnic Pre-service Technicians Questionnaire (CNAPPTQ). The questionnaire consisted of 103 tasks on diagnosis and repair skills needed by Polytechnic Pre-service Technicians, adopted from the curriculum of National Automobile Technician Education (NATE) and National Vocational Certificate in Automotive / Mechatronics as approved by National Board for Technical Education, (NBTE). The questionnaire is divided into two parts: I & II, Part I contains items designed to obtain personal information of the respondents, while Part II is divided into four sub-sections (I, II, III & IV). The instrument was developed based on the framework of COPA Model, adapted from Lenburge et al (2009). A four-point rating scale ranging from Highly Needed (HN) = 4, Needed (N) = 3, Moderately Needed (MN) = 2, to Least Needed (LN) = 1 was employed in sub-section I, while four-point rating scaled ranging from Most relevant (4), Highly relevant (3), Moderately relevant (2) to Less relevant = 1 was also used. The data generated were subjected to analysis using mean and standard deviation with the help of Statistical Package for Social Sciences (SPSS) version 23 (2015).

III. Results and Discussion

The results are presented in tables with discussion. Mean and standard deviation statistical tools were employed for the analysis of data for all of the research questions. The results for the research questions are presented as follows:

To answer the research question one, data collected was subjected to analysis using Mean and Standard deviation with the help of SPSS. Table 1 shows the results of the essential competencies needed by Polytechnic Pre-service Technicians for diagnosis and repair of modern automobile. Results of items 5, 7, 10, and 12 have shown that essential competencies are highly needed with all the items having a mean score of 3.6 respectively and a standard deviation of 0.605, 0.604, 0.558 and 0.585 respectively as rated by Pre-service technicians for diagnosis and repair of modern automobiles Therefore, it can be concluded that all the 12 essential

competencies are needed for diagnostic and repairs of modern automobile by Pre-service technicians in Polytechnics in Northern Nigeria with a total grand mean of 3.50 which revealed that, the items are highly needed for the training of technicians in Nigerian Polytechnics.

Table 1: Mean and Standard Deviation on the Essential Competencies Needed by Polytechnic Pre-service Technicians for diagnostic and repairs of modern automotive in Northern Nigeria.

S/N	Essential Competencies	N	\bar{X}	SD	Remarks
Basic Electronics and Technology of Modern Automobile					
1	Knowledge of the engine management system	192	3.52	.619	Most Needed
2	Knowledge of the basics of the Auto-Electronics	192	3.44	.603	Highly Needed
3	Knowledge of the functions of the Exterior Accessories	192	3.44	.653	Highly Needed
4	Knowledge of the Modern Automobile Sensors	192	3.52	.636	Most Needed
5	Inspect, fault diagnosis and analysis of the performance of engine sub-system	192	3.60	.605	Most Needed
Fault Diagnosis and Repair of Electronic sensor and Actuator on Modern Automobile System					
6	Check and repair vehicle, electric supply from the battery, charging and starting system	192	3.44	.578	Highly Needed
7	Check and repair various types of vehicle electronic control systems and devices.	192	3.60	.604	Most Needed
8	Conduct faults analysis on various types of vehicle electronic control systems	192	3.52	.642	Most Needed
9	Conduct fault diagnosis on vehicle emission control system	192	3.52	.651	Most Needed
10	Check DC and AC Technology in Modern Automobile	192	3.60	.558	Most Needed
Overall Grand Mean			3.50	0.617	

Table 2: Mean and Standard Deviation of the relevant outcome statements that integrate those competencies needed.

S/N	Outcome Statement	N	\bar{X}	SD	Remarks
1	Identify the structure and function of Modern Engine Management System				
i.	Formation of the air, Smog and Vacuum pump	192	3.60	.578	Most Relevant
ii.	Functions of the computers,	192	3.44	.616	Highly Relevant
iii.	Modules and chips	192	3.62	.695	Most Relevant
iv.	Functions of EGR System	192	3.60	.656	Most Relevant
i.	Function of Solenoid and Relays	192	3.60	.646	Most Relevant
ii.	Functions of Sensors	192	3.64	.614	Most Relevant
iii.	Functions of Valves	192	3.60	.670	Most Relevant
iv.	Functions of Miscellaneous Engine Management	192	3.52	.752	Most Relevant
2	Identify the Basic of the Modern Automobile Electronic System				
i.	12 volts Portable Appliances,	192	3.60	.622	Most Relevant
ii.	Alarm and Security systems,	192	3.44	.626	Highly Relevant
iii.	Amplifiers,	192	3.60	.640	Most Relevant
iv.	Antenna,	192	3.36	.689	Relevant
v.	Audio Terminal and Connector,	192	3.60	.760	Most Relevant
vi.	Audio in Dash Units,	192	3.44	.724	Highly Relevant
vii.	Audio Install Accessories,	192	3.44	.782	Highly Relevant
viii.	Auxiliary Cables	192	3.52	.654	Most Relevant
ix.	GPS and Navigation,	192	3.44	.716	Highly Relevant
x.	Equalizers, Crossovers and Processors	192	3.36	.761	Highly Relevant
3	Understand the Exterior Accessories of Modern Automobile				
i.	Antenna Cable Mast,	192	3.44	.769	Highly Relevant
ii.	Cover and Cover Accessories,	192	3.52	.741	Most Relevant
iii.	Deflectors (Sun, Vent and Windows),	192	3.36	.673	Highly Relevant
iv.	Door Handle and Door Parts	192	3.52	.653	Most Relevant
v.	Exterior Light	192	3.44	.665	Highly Relevant
vi.	Relays – Cornering Light, etc	192	3.44	.584	Highly Relevant
4	Understand the Function of Modern Automobile Sensors				
i.	ABS Wheel Speed Sensors Wire Harness,	192	3.52	.567	Most Relevant
ii.	Accelerator Pedal Position Sensor,	192	3.52	.526	Most Relevant
iii.	Acceleration Pedal Sensor	192	3.60	.535	Most Relevant
iv.	Air Bag Impact Sensor,	192	3.52	.581	Most Relevant
v.	Air Charge Temperature Sensors,	192	3.52	.532	Most Relevant
vi.	Air Cleaner Temperature Sensor	192	3.60	.588	Most Relevant

Competency Training Needs Of Polytechnic Pre-Service Technicians For Diagnosis And ..

S/N	Outcome Statement	N	\bar{X}	SD	Remarks
vii.	Barometric Temperature Sensor	192	3.60	.672	Most Relevant
viii.	Brake Fluid Pressure Sensor	192	3.60	.561	Most Relevant
ix.	Camshaft Position Sensor	192	3.52	.582	Most Relevant
x.	Crankshaft Position Sensor	192	3.52	.535	Most Relevant
xi.	Coolant Temperature Sensor	192	3.44	.606	Highly Relevant
xii.	EGR Position Sensor	192	3.60	.570	Most Relevant
5	Conducting analysis on Diagnostic results of the various Engine Sub-systems				
i.	Conductivity and insulation of control circuits,	192	3.44	.538	Highly Relevant
ii.	Electronic actuations and feedback signals,	192	3.60	.611	Most Relevant
iii.	the operating condition of electronic control devices and actuators	192	3.52	.635	Most Relevant
iv.	the output signals of sensors,	192	3.60	.597	Most Relevant
v.	pressure variations of cylinders,	192	3.28	.734	Highly Relevant
vi.	intake and exhaust systems,	192	3.44	.603	Highly Relevant
v.	operating pressure of fuels and lubricants	192	3.44	.568	Highly Relevant
6	Inspecting and Repairing Vehicle Electric supply from Battery Charging System				
i.	common faults in vehicle battery,	192	3.60	.540	Most Relevant
ii.	charging,	192	3.52	.574	Most Relevant
iii.	electric supply and	192	3.60	.614	Most Relevant
iv.	starting systems,	192	3.52	.580	Most Relevant
7	Checking and Repairing Various Types of Vehicle Electronic Control Systems and Devices				
i.	conducting common fault diagnosis in different types of vehicle electronic control systems,	192	3.52	.535	Most Relevant
ii.	inspecting the result of the diagnosis,	192	3.44	.739	Most Relevant
iii.	repairing parts of various types of vehicle electronic systems as well as circuit/data systems	192	3.60	.587	Most Relevant
8	Performing Analysis on Various Types of Vehicle Electronic Control System				
i.	Fault diagnosis and repairs on various types of vehicle electronic control systems and equipment and repair them accordingly	192	3.60	.597	Most Relevant
ii.	Finding out common problems of vehicle electronic control systems and equipment by visual inspection	192	3.60	.604	Most Relevant
iii.	Selecting suitable tools and	192	3.44	.756	Highly Relevant
iv.	instrument to inspect and measure various types of vehicle electronic control systems				
v.	Calculating and analysing of the problems in the electronic control systems	192	3.52	.588	Most Relevant
vi.	Conducting appropriate rectification work according to the faults	192	3.52	.503	Most Relevant
vii.	Measure, testing and evaluating the operation and efficiency of various types of vehicle electronic/data control system	192	3.60	.587	Most Relevant
9	Performing Fault Diagnosis on Vehicle Emission Control System				
i.	special equipment and instruments to assess the diagnostic process,	192	3.60	.524	Most Relevant
ii.	rectification to eliminate fault according to diagnostic results	192	3.44	.528	Highly Relevant
iii.	testing vehicle emission control systems, using special equipment and instrument,	192	3.60	.646	Most Relevant
iv.	completing a simple fault report sheets after rectification	192	3.52	.659	Most Relevant
10	Checking AC and DC Technology for Modern Automobile				
i.	Know Basic concept of current, voltage and resistance	192	3.36	.753	Relevant
ii.	Know Handling power sources and measuring instrument,	192	3.52	.574	Most Relevant
iii.	Know circuit diagram for the analysis of electrical components	192	3.44	.689	Highly Relevant
iv.	Measurements on series and parallel circuits, voltage dividers and mixed circuits.	192	3.60	.688	Most Relevant
	Grand Mean		3.50	0.636	

Research question two was raise to find out relevant outcome statements that integrate those competencies in research question 2. It has 15 main items and 72 sub-items.

The results presented in the table 2 above shows that, eight sub-items under main item one, had mean and standard deviation ranging from 3.44 to 3.60 and .57 to .75 respectively. Out of the eight sub-items on modern engine management system, item ii and vii are rated as highly relevant with a mean score and standard deviation of 3.44, 3.52 and .616, .752 respectively, while the remaining six items with mean and standard deviation of 4.5 and .641 were rated as most effective learning outcomes that will integrate the essential competencies outlined in table 2

Subsequently, the results presented in the table 2 above shows that, ten sub-items under main item ii, iv, vi, vii, viii, ix and x are rated highly effective with a mean score and standard deviation ranging from 3.36 to 3.52 and .622 to .782 respectively, Item six in the table 2 shows that four sub-items item i and iii have a mean and standard deviation of 3.60 and .540, .640 respectively regarded as most effective. While the remaining item ii and iv have a mean ranging from 3.44 to 3.52 were rated highly relevant to integrate the essential competencies outline in table 2. Item seven in the table 2 above have three sub-items two out of the three sub-items have a mean and standard deviation ranging from 3.44 to 3.52 and .535 to .739 respectively.

Competencies as outline in table 1 above. Item twelve (12) have four sub-items item 1 and 3 have a mean of 3.60 respectively and a standard deviation ranging from .682 to .766 rated as highly relevant learning outcomes. While item 2 and 4 have a mean of 3.60 and a standard deviation ranging from .540 to .541 rated as most relevant learning outcomes that integrate essential competencies. These findings portray the finding of Udogo, (2011) on emerging technology skills require at technical college level that all the emerging technology skill are needed for the training of students.

Table 3: Mean and Standard deviation on the relevant Interactive Learning Strategies needed by Polytechnic Pre-service Technicians in Northern Nigeria.

S/N	Interactive Strategies	N	X	Std	Remarks
1	Interactive power point to show the structure of the Engine Management System	192	3.52	.659	Most Relevant
2	Using project approach to show basic operation of Modern Auto-Electronic components	192	3.52	.679	Most Relevant
3	Using project approach to show the function of Modern Automobile Exterior Accessories	192	3.44	.645	Highly Relevant
4	Using interactive white-board to show how to detect different types of Automobile – Sensors	192	3.52	.664	Most Relevant
5	Using power point/videos clip to demonstrate inspections, fault and diagnosis of various engine sub-system	192	3.44	.684	Highly Relevant
6	Demonstrate with the aid of projector how to check and repair vehicle battery, charging, electric supply and starting systems.	192	3.52	.604	Most Relevant
7	Using computer animations to practically demonstrate various types of vehicle electronic control systems	192	3.60	.628	Most Relevant
8	Using videos clip to show how measuring instruments and equipment to check and repair various types of vehicle electronic control systems	192	3.44	.650	Highly Relevant
9	Using power point to show fault diagnosis on vehicle emission control systems	192	3.44	.690	Highly Relevant
10	Showing practically by computer and simulation AC and DC Technology for Modern Automobile	192	3.44	.681	Highly Relevant
Grand Mean			3.49	0.654	

To answer research question 3 the data collected was subjected to analysis using Mean and Standard deviation with the help of SPSS. Table 3 shows the results on the most relevant interactive learning strategies to validate achievement of those competencies needed by Polytechnic Pre-service technicians for diagnosis and repair of modern automobile. Results of items 7, 8, and 10 have shown that the most effective interactive learning strategies are mostly relevant as revealed by pre-service technicians for diagnosis and repair of modern automobiles with the items having the mean score of 3.60 and a standard deviation of .628, .650 and .681 respectively. Therefore, it can be concluded that all the 21 learning strategies are effective for diagnostic and repair of modern automobile in Polytechnics in Northern Nigeria.

Table 4: Mean and Standard deviation on the relevant Performance Assessment Methods in validate achievement of outcomes for diagnosis and repairs of Modern Automobile in Northern Nigeria.

S/N	Performance Assessment	N	X	Std	Remarks
1	Adopting Real work/real time activities at the workplace	192	3.44	.599	Highly Relevant
2	Using work activities in a simulated workplace	192	3.44	.619	Highly Relevant
3	Using simulation exercises/role-plays,	192	3.44	.674	Highly Relevant
4	Using Projects to teach the required competency	192	3.44	.685	Highly Relevant
5	Using Demonstrations to teach required competency	192	3.52	.666	Most Relevant
6	To use activity sheets to assess the essential competency	192	3.52	.652	Most Relevant
7	Presentations / Using Oral answers to pose questions to	192	3.52	.661	Most Relevant

S/N	Performance Assessment	N	\bar{X}	Std	Remarks
	students to assess learning outcome				
8	Written questions to assess performance	192	3.52	.681	Most Relevant
9	Using Interviews to validate achievement	192	3.44	.735	Highly Relevant
10	Used Self-assessment to determine the achievement of competency	192	3.44	.654	Highly Relevant
Grand Mean			3.44	0.658	

To answer research question four the data collected was subjected to analysis using Mean and Standard deviation with the help of SPSS. Table 4 shows the results on the relevant performance assessment methods that validate achievement of outcomes required by Polytechnic Pre-service technicians for diagnosis and repair of modern automobile. The results of the 21 items have shown that the relevant performance assessment methods that validate achievement of outcomes of 1 to 21 items are highly relevant by pre-service technicians for diagnosis and repair of modern automobiles with all the 21 items having a mean score between 3.20 to 3.52 and standard deviation ranging from .599 to .735 respectively. It can be concluded that all the 21 performance assessment methods are highly relevant for diagnostic and repairs of modern automobile required by Pre-service technicians in Polytechnics in Northern Nigeria.

IV. Conclusion

The findings revealed that Competencies in Basic Electronics and Technology of modern Automobile, Diagnosis and Repair of Electronic sensor and Actuator on Modern Automobile System, Transmission System/Fuelling system and Modern Automobile Steering, Braking and Suspension system are essentially needed in training of polytechnic Pre-service Technicians in diagnosis and repairs of modern Automobiles. Furthermore Ezeama, (2016), stated that the automotive technicians need a variety of expertise in vast areas of basic electronics and technology in order to diagnose and repair cars accurately and quickly. Researchers like (Vincent (2014, Ezenwaka and Tijjani 2013, Wilcox, 2013, Erjavec 2012 and Stephen et-al, 2011) stated that computers and electronic devices are used to control the operation of an engine. Because of these controls, today's automobiles use less fuel, perform better, and run cleaner than those in the past. The findings, was in agreement with the findings as contained in the performance evaluation methods for the training of the polytechnic pre-service technicians for diagnosis and repair of modern automobile in northern Nigeria. Therefore, whatever remedies are proffered to reduce the effect of the identify obstacles should as well apply to other colleges of education technical and Nigerian universities in Nigeria.

V. Recommendations

Based on the finding of this study, the following recommendations are stated as follows:

- i. Identified needed essential competencies of the modern automobile technology be integrated into NBTE curriculum for the training of technicians in order to prepare them to be able to diagnose and repair modern automobiles.
- ii. Identified essential competencies needed for training of Polytechnic Pre-service Technicians for diagnosis and repairs of Modern Automobile that are required will help lecturers in developing a lessons using the identified competencies that are essentially needed by Pre-service technicians for diagnosis and repair of modern automobiles in order for them to prepare on how to teach them appropriately.
- iii. Identified most effective interactive learning strategies that integrate the essential competencies needed for training of Polytechnic Pre-service Technicians for diagnosis and repairs of Modern Automobile will help the lecturers/instructors to identify the appropriate learning strategies to be apply when delivering the lesson.
- iv. Identified most effective performance assessment methods that validate achievement of outcomes of required essential competencies needed by Polytechnic Pre-service Technicians for diagnosis and repairs of Modern Automobile will help lecturers in evaluating process before, during and after the lessons in identifying the appropriate evaluation techniques as per the treated topic.

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