



Research Paper

## Repairs and Diagnosis of Modern Automotive Skill Development for Competitive Advantage in Automobile Training Programs at Technical Colleges Level in North-Eastern State of Nigeria

Dr. Babayo Yakubu Adamu

Department of Vocational and Technical Education  
ABUBAKAR TATARI LI POLYTECHNIC, BAUCHI.

### Abstract

The main purpose of this study was to determine competency on repairs and diagnosis of modern automotive skills development for competitive advantage in automotive training programs at technical college level in state of Nigeria. The training needs of technical college technicians for diagnosis and repairs of modern automobiles in north-eastern state Nigeria. The study sought to answer two research questions using competency and performance method of assessment as part of 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 carry out repairs on modern cars. A descriptive survey research design was adopted for the study. The population for the study was made up of 250 technicians in automotive technology in the NBTE accredited Technical Colleges in North-Eastern State of Nigeria. Out of 250 a sample of 152 was randomly selected for the study using Kregcie and Morgan Sample Table (1970). The questionnaire consisted of 152 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, (see Appendix I). 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 (2019). 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. A reliability test of the instrument was also conducted and analysed using Cronbach Alpha coefficient method and yielded an overall reliability coefficient of 0.80. Data generated from the use of the questionnaire was analyzed with Statistical Package for Social Sciences (SPSS) 23<sup>rd</sup> version software using mean and standard deviation to answer the research questions. Findings revealed that Competencies in Basic Electronics and Technology of modern Automotive, Diagnosis and Repair of Electronic sensor and Actuator on Modern Automotive System, Transmission System, fueling system and Modern Automobile Steering, Braking and Suspension system are essentially needed in the training of Technical College 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 modern technology skills should be integrated into the curriculum of Automotive Technology programme in Nigerian Technical Colleges. Identified essential competencies will help lecturers in developing lesson plan using the competencies that are essentially needed by automotive technicians in order for them to prepare on how to teach them appropriately.

The purpose of this study was on repairs and diagnosis of automotive training skills development for competitive advantage in automobile training programs in north-eastern state of Nigeria.

Received 06 June., 2026; Revised 15 June., 2026; Accepted 17 June., 2026 © The author(s) 2026.

Published with open access at [www.questjournals.org](http://www.questjournals.org)

## 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, 2016). 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 and college 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 technician's product in Nigeria lack the requisite knowledge and skills on how to go about diagnosing and repair of modern automobile (Jalal, 2016). In fact, this trend would render them irrelevant in their job places, so Integrating e-lectures for skills development in Automotive engine management and electrical system for training automobile programs will have no doubt of bringing positive transformation in the training of technicians in technical Colleges, Polytechnics and Colleges of education technical.

The main objective of skill in Nigerian Technical Colleges 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. The Technical Colleges education system is structured into three (3) programme namely; National Business and Technical Examination Board (NBTEB), West African Examination Council (Technical) lasted for three years programme after vocation training at lower level 1-3. For decades educational sectors have recognized that skills training is decreasing in our technical colleges education system as students tend to be more exposed to rote learning than the competency to operate positively in the labour market.

Technical Colleges graduates are likely to be produced without skills and competencies required by most of the industries and labour market needs to industries. If such products fail to perform as expected, this could portray the educational institutions at a technical college level in a bad light before the public. If this continues unaddressed, it could lead to bankruptcy in product quality. No wonder Paulson (2021) referred to the graduates of technical colleges programmes as under prepared due to their lack of skills. Paulson's observation portrayed that such technical college programmes are affecting the graduate and their prospective employers a disservice. Though the above observation tends to be generalized for technical and vocational education programmes, the researcher is of the view that the auto mechanics program run in Nigerian technical colleges might also be affected as a result of recent changes in the Automobile industries, current automobiles are using electronic controls that were once done by hydraulics and vacuum, the automatic transmission that was once shifted by engine vacuum and hydraulic pressure differential is now being computerised. Such computer, use inputs from various sensors to determine optimal shift points to maintain efficiency and fuel economy (Gilles, 2018). Modern automobile is a blend of 20<sup>th</sup> century and 21<sup>st</sup> 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 sensor indeed, almost every other function within the engine is controlled by an on-board computer (Akinola, 2019) Brain Box System.

The major challenges faced by the current training of automobile instructors/technicians are the emergence of modern vehicles that have too many electronic circuits in operation, maintenance and servicing. These types of cars require the use of computer as a platform and scan tools for their diagnosis and repairs.

Yakubu (2020) have also observed that, to prepare technicians in automobile technology, the curriculum needs to provide students with requisite skills necessary for industrial demands in automobile repairs and maintenance. Thus, a gap created by the anomaly which leads to question on the effectiveness of current training in automobile technology programmes in Nigerian Technical Colleges on addressing the challenge of maintenance, repairs and servicing of modern automobiles. These developments call for an up-date on the way training of automobile technicians in technical colleges is being conducted. For many years, automotive electricians just needed to understand basic electrical wiring principles, due to increase in the complexity of the automobile industries need to understand complex wiring circuits with solid-state computer control, along with the basics (Peugeot Automobile Nigeria, 2019). In addition, Peugeot Automobile of Nigeria (2019), identified the daily tasks of modern automotive technician to include but not limited to:

1. Diagnosing the source of problems
2. Using electronic testing equipment
3. Reading and interpreting the output of diagnostic equipment
4. Figuring out how to fix problems once they are diagnosed
5. Using technical manuals, reading charts and diagrams
6. Repairing, overhauling, or replacing systems and parts
7. Doing routine maintenance like oil changes and tire rotation and

#### 8. Work-site auto design, maintenance of tools and equipment

Automotive technology students are expected to have the ability to diagnose electronic and electrical problems, interpret measurement, read sensors and actuators on automobiles becomes something of great importance (Wright, 2013). Wright further maintained that, automotive technicians must possess a good understanding of electrical and electronics be able to visualize the operation of the components they are troubleshooting.

Effective technicians training embeds into using integrating E-lectures in diagnosis and repairs of modern automotive, skills and abilities need to be embedded into the curriculum. Computer plat-form integrating basic electronics and modern technologies, modern automotive sensors and actuators, modern automotive transmission and fueling systems as well as modern automotive steering, braking and suspension system have can improved learning. According to Abubakar, Yahaya and Tijjani (2019), for technicians to effectively troubleshoot and repair modern vehicles, they are required to possess essential competencies to apply across basic knowledge of computer a system to electronic controls, operation of vehicle computer sensors and actuators, operation of computer-controlled systems work, operation of modern vehicle diagnostic tools and equipment and carrying out maintenance on vehicles according to the manufacturer's specifications.

#### **Statement of the Problem**

It is a common knowledge that a large proportion of automotive technicians, both the experience and trainees in Nigeria find it extremely difficult to use computer as a soft-ware or plat-form to diagnose, repair and maintain modern cars (Akinola and Ogedenga, 2019). Indeed, this has worked to the effort that most of the automobile workshops in the country now currently are somehow out of business. The problems faced by the workshops in the country as far as diagnose, repairs and maintenance of modern cars is concerned and could be attribute to reasons such as waste of time in detecting faults, damage to engine without the use of computerized diagnostic tools and lack of appropriate maintenance practices (Agyapung, 2020). Tijjani (2020) stated that most of the training received by technicians in diagnosing, repair and maintenance activities of modern vehicle is without sound and state-of-the-art maintenance practice.

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 1-year programme mean to take care of those that cannot be admitted into National Diploma ND levels (NBTE, 2020). 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. an urgent intervention in training programmes will be necessary through an e-lectures platform.

To this end, the researcher intends to carry out this study to determine repairs and diagnosis of modern automotive skills development for advantage in automobile training programs at technical colleges level in north-eastern state of Nigeria for inclusion into automotive technology curriculum in Nigeria.

#### **Objectives of the Study**

The main purpose of the study was to determine the competency training needs of technical colleges technicians for diagnosis and repairs of Modern vehicles in Northern Nigeria using competency outcome performance assessment (COPA) model approach as a guide. Specifically, the study sought to: -

1. Identify the essential competencies needed by technical college 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.

#### **Research Questions**

The following research questions were formulated to guide the study:

1. What are the essential competencies needed by technical college Technicians for diagnosis and repair of Modern Automobiles in Northern Nigeria?
2. What are the relevant outcome statements that integrate the competencies needed by technical college technicians for diagnosis and repair of Modern Automobile in Northern Nigeria?

## II. Methodology

The design of the study was a descriptive survey because it best 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. Tuckman (1999) explained that in a descriptive survey, variables are frequently studied using a simple counting procedure with little or no attempt made to determine in a systematic fashion the relationship between them and other relevant variables. Therefore, with a representative sample of the larger population of interest, one will be able to gather data covering competencies, outcome, performance/teaching strategies and assessment/evaluation from all the possible sources from which the sample will be drawn in this study.

The geographical area of the study was North – Eastern Nigeria. Northern Nigeria comprised of: Adamawa, Bauchi, Borno, Gombe, Yobe, and Taraba, states. Nigeria has an area of 233,672, sq kilometres and lies between latitude 4° and 30° North of the equator and longitudes 30 and 140 East of the Greenwich meridian. This is entirely within the tropical zone.

The target population for the study was defined to include all technicians in the area of automotive technology in both state and federal technical colleges in North – Eastern Nigerian, while the accessible population is the technicians within the researcher’s reach. In this study the accessible population comprised of 250 technicians in the 20 technical and vocational technical colleges in North – Eastern Northern Nigerian. Most of them have had several years of teaching auto- mechanics technology and therefore, they are in the best position to furnish the researcher with the information needed to answer the research question of this study.

The instrument for data collection was a structured questionnaire titled: Competency Needs of Auto-mechanic Technical College Technicians Questionnaire (CNATCTQ). The questionnaire consisted of 192 tasks on diagnosis and repair skills needed by Technical College 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, (see Appendix I), Part I contains items designed to obtain personal information of the respondents, while Part II is divided into two sub-sections (I & II). Part I contains 21 items on two clustered essential competencies needed for diagnosis and repair of modern automotive. Sub-section II has 21 items and 108 subs – items on relevant outcome statements that will integrate the essential competencies listed in sub-section I.

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.

## III. RESULT AND DISCUSSIONS

### *Table 1: Research Question 1: What are the essential competencies needed by Polytechnic Pre-service Technicians for diagnosis and repairs of Modern Automotive?*

To answer this research question, 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 13 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. The remaining 17 items on essential competencies are rated as needed by the respondents with mean score ranges between 3.44 to 3.52. Therefore, it can be concluded that all the 21 essential competencies are needed for diagnostic and repairs of modern automobile by technicians in technical colleges in North – Eastern 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 Technical College Technicians for diagnostic and repairs of modern automotive in Northern Nigeria.**

S/N	Essential Competencies	N	$\bar{X}$	SD	Remarks
<b>Basic Electronics and Technology of Modern Automobile</b>					
1	Knowledge of the engine management system	152	3.52	.619	Most Needed
2	Knowledge of the basics of the Auto-Electronics	152	3.44	.603	Highly Needed
3	Knowledge of the functions of the Exterior Accessories	152	3.44	.653	Highly Needed
4	Knowledge of the Modern Automobile Sensors	152	3.52	.636	Most Needed
5	Inspect, fault diagnosis and analysis of the	152	3.60	.605	Most Needed

S/N	Essential Competencies	N	$\bar{X}$	SD	Remarks
performance of engine sub-system					
<b>Fault Diagnosis and Repair of Electronic sensor and Actuator on Modern Automobile System</b>					
6	Check and repair vehicle, electric supply from the battery, charging and starting system	152	3.44	.578	Highly Needed
7	Check and repair various types of vehicle electronic control systems and devices.	152	3.60	.604	Most Needed
8	Conduct faults analysis on various types of vehicle electronic control systems	152	3.52	.642	Most Needed
9	Conduct fault diagnosis on vehicle emission control system	152	3.52	.651	Most Needed
10	Check DC and AC Technology in Modern Automobile	152	3.60	.558	Most Needed
11	Check Electronic Diesel Control (EDC)	152	3.52	.639	Most Needed
<b>Fault Diagnosis and Repair of Modern Automobile Transmission System/Fueling system</b>					
12	Check and repair vehicle transmission systems	152	3.52	.588	Most Needed
13	Conduct fault diagnosis on vehicle transmission systems	152	3.60	.585	Most Needed
14	Conduct fault diagnosis on various vehicle fuel supply systems	152	3.52	.579	Most Needed
15	Conducting fault diagnosis on vehicle ignition systems	152	3.52	.622	Most Needed

**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	<b>Identify the structure and function of Modern Engine Management System</b>				
i.	Formation of the air, Smog and Vacuum pump	152	3.60	.578	Most Relevant
ii.	Functions of the computers,	152	3.44	.616	Highly Relevant
iii.	Modules and chips	152	3.62	.695	Most Relevant
iv.	Functions of EGR System	152	3.60	.656	Most Relevant
i.	Function of Solenoid and Relays	152	3.60	.646	Most Relevant
ii.	Functions of Sensors	152	3.64	.614	Most Relevant
iii.	Functions of Valves	152	3.60	.670	Most Relevant
iv.	Functions of Miscellaneous Engine Management	152	3.52	.752	Most Relevant
2	<b>Identify the Basic of the Modern Automobile Electronic System</b>				
i.	12 volts Portable Appliances,	152	3.60	.622	Most Relevant
ii.	Alarm and Security systems,	152	3.44	.626	Highly Relevant
iii.	Amplifiers,	152	3.60	.640	Most Relevant
iv.	Antenna,	152	3.36	.689	Relevant
v.	Audio Terminal and Connector,	152	3.60	.760	Most Relevant
vi.	Audio in Dash Units,	152	3.44	.724	Highly Relevant
vii.	Audio Install Accessories,	152	3.44	.782	Highly Relevant
viii.	Auxiliary Cables	152	3.52	.654	Most Relevant
ix.	GPS and Navigation,	152	3.44	.716	Highly Relevant
x.	Equalizers, Crossovers and Processors	152	3.36	.761	Highly Relevant
3	<b>Understand the Exterior Accessories of Modern Automobile</b>				
i.	Antenna Cable Mast,	152	3.44	.769	Highly Relevant
ii.	Cover and Cover Accessories,	152	3.52	.741	Most Relevant
iii.	Deflectors (Sun, Vent and Windows),	152	3.36	.673	Highly Relevant
iv.	Door Handle and Door Parts	152	3.52	.653	Most Relevant
v.	Exterior Light	152	3.44	.665	Highly Relevant
vi.	Relays – Cornering Light, etc	152	3.44	.584	Highly Relevant
4	<b>Understand the Function of Modern Automobile Sensors</b>				
i.	ABS Wheel Speed Sensors Wire Harness,	152	3.52	.567	Most Relevant

S/N	Outcome Statement	N	$\bar{X}$	SD	Remarks
ii.	Accelerator Pedal Position Sensor,	152	3.52	.526	Most Relevant
iii.	Acceleration Pedal Sensor	152	3.60	.535	Most Relevant
iv.	Air Bag Impact Sensor,	152	3.52	.581	Most Relevant
v.	Air Charge Temperature Sensors,	152	3.52	.532	Most Relevant
vi.	Air Cleaner Temperature Sensor	152	3.60	.588	Most Relevant
vii.	Barometric Temperature Sensor	152	3.60	.672	Most Relevant
viii.	Brake Fluid Pressure Sensor	152	3.60	.561	Most Relevant
ix.	Camshaft Position Sensor	152	3.52	.582	Most Relevant
x.	Crankshaft Position Sensor	152	3.52	.535	Most Relevant
xi.	Coolant Temperature Sensor	152	3.44	.606	Highly Relevant
xii.	EGR Position Sensor	152	3.60	.570	Most Relevant
<b>5</b>	<b>Conducting analysis on Diagnostic results of the various Engine Sub-systems</b>				
i.	Conductivity and insulation of control circuits,	152	3.44	.538	Highly Relevant
ii.	Electronic actuations and feedback signals,	152	3.60	.611	Most Relevant
iii.	the operating condition of electronic control devices and actuators	152	3.52	.635	Most Relevant
iv.	the output signals of sensors,	152	3.60	.597	Most Relevant
v.	pressure variations of cylinders,	152	3.28	.734	Highly Relevant
vi.	intake and exhaust systems,	152	3.44	.603	Highly Relevant
v.	operating pressure of fuels and lubricants	152	3.44	.568	Highly Relevant
<b>6</b>	<b>Inspecting and Repairing Vehicle Electric supply from Battery Charging System</b>				
i.	common faults in vehicle battery,	152	3.60	.540	Most Relevant
ii.	charging,	152	3.52	.574	Most Relevant
iii.	electric supply and	152	3.60	.614	Most Relevant
iv.	starting systems,	152	3.52	.580	Most Relevant
<b>7</b>	<b>Checking and Repairing Various Types of Vehicle Electronic Control Systems and Devices</b>				
i.	conducting common fault diagnosis in different types of vehicle electronic control systems,	152	3.52	.535	Most Relevant
ii.	inspecting the result of the diagnosis,	152	3.44	.739	Most Relevant
iii.	repairing parts of various types of vehicle electronic systems as well as circuit/data systems	152	3.60	.587	Most Relevant
<b>8</b>	<b>Performing Analysis on Various Types of Vehicle Electronic Control System</b>				
i.	Fault diagnosis and repairs on various types of vehicle electronic control systems and equipment and repair them accordingly	152	3.60	.597	Most Relevant
ii.	Finding out common problems of vehicle electronic control systems and equipment by visual inspection	152	3.60	.604	Most Relevant
iii.	Selecting suitable tools and	152	3.44	.756	Highly Relevant
iv.	instrument to inspect and measure various types of vehicle electronic control systems	152	3.52	.588	Most Relevant
v.	Calculating and analyzing of the problems in the electronic control systems	152	3.52	.503	Most Relevant
vi.	Conducting appropriate rectification work according to the faults	152	3.52	.503	Most Relevant
vii.	Measure, testing and evaluating the operation and efficiency of various types of vehicle electronic/data control system	152	3.60	.587	Most Relevant
<b>9</b>	<b>Performing Fault Diagnosis on Vehicle Emission Control System</b>				
i.	special equipment and instruments to assess the diagnostic process,	152	3.60	.524	Most Relevant
ii.	rectification to eliminate fault according to diagnostic results	152	3.44	.528	Highly Relevant
iii.	testing vehicle emission control systems, using special equipment and instrument,	152	3.60	.646	Most Relevant
iv.	completing a simple fault report sheets after rectification	152	3.52	.659	Most Relevant
<b>10</b>	<b>Checking AC and DC Technology for Modern Automobile</b>				
i.	Know Basic concept of current, voltage and resistance	152	3.36	.753	Relevant
ii.	Know Handling power sources and measuring instrument,	152	3.52	.574	Most Relevant

S/N	Outcome Statement	N	$\bar{X}$	SD	Remarks
iii.	Know circuit diagram for the analysis of electrical components	152	3.44	.689	Highly Relevant
iv.	Measurements on series and parallel circuits, voltage dividers and mixed circuits.	152	3.60	.688	Most Relevant
<b>11</b>	<b>Diagnosing fault on Electronic Diesel Control</b>				
i.	Using hand-held testers, engine analyze chassis dynamometer and exhaust gas analyzer as describe in the service manual	152	3.60	.549	Most Relevant
ii.	arranging rectification defects according to diagnostic results,	152	3.52	.598	Most Relevant
iii.	testing various types of diesel engine accurately and successful rectification	152	3.60	.605	Most Relevant
iv.	conduct test by using instruments and equipment, e.g. Combustion Process, Pollutant Emission, Signal, Material and Energy flow, Sensors and Actuators	152	3.60	.548	Most Relevant
v.	completing simple fault report sheets accurately after confirming that rectification is done	152	3.52	.532	Most Relevant
<b>12</b>	<b>Inspecting, Repairing and Replacing various Kinds of Vehicle Transmission System</b>				
i.	identifying the general problems in various type of vehicle transmission systems by visual inspection,	152	3.60	.540	Most Relevant
ii.	conducting speed lost test for automatic transmission systems and assess the result,	152	3.52	.682	Most Relevant
iii.	dismantling replacing, overhaul and re-assemble the clutch, various kinds of gearboxes, drive shaft and differential	152	3.63	.541	Most Relevant
iv.	eliminating typical system failure	152	3.20	.766	Relevant
<b>13</b>	<b>Fault Diagnosis on Vehicle Transmission System</b>				
i.	Diagnosing fault on various type of vehicle transmission systems using special equipment and instruments	152	3.52	.534	Most Relevant
ii.	conducting / arranging rectification to eliminate the fault according to diagnostic results,	152	3.44	.569	Highly Relevant
iii.	test of transmission systems, using special equipment and instruments to conduct the tests,	152	3.65	.606	Most Relevant
iv.	completing simple fault report sheet after rectification	152	3.36	.636	Relevant
<b>14</b>	<b>Identify the Structure and Operating Principles of Various Vehicle Fuel System</b>				
i.	Conduct faults diagnosis process for various vehicle fuel systems such as using exhaust gases	152	3.66	.588	Most Relevant
ii.	Conduct fuel system fault Diagnosis	152	3.36	.618	Relevant
iii.	Using the operation of testing equipment and instrument such as: various types of on-board diagnostic systems	152	3.60	.612	Most Relevant
<b>15</b>	<b>Conducting Fault Diagnosis of Vehicle Ignition System</b>				
i.	conducting complicated fault diagnosis on vehicle ignition systems using special equipment and instruments	152	3.60	.547	Most Relevant
ii.	arranging rectification to eliminate the fault according to diagnosis results.	152	3.60	.570	Most Relevant
iii.	testing the ignition systems, using relevant equipment and instrument	152	3.44	.585	Highly Relevant
iv.	Completing simple fault report after rectification	152	3.36	.525	Highly Relevant

**Research question two was raise to find out relevant outcome statements that integrate those competencies in research question 2. It has 21 main items and 92 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, 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, while the remaining three items with the mean and standard deviation of ranging from 3.60 and .622 to .782 were rated as most effective learning outcomes that will integrate the essential competencies outline in table 2. Item three in table 2 shows that six sub-items under main items three

(Antenna Cable Mast, Cover and Cover Accessories, Deflectors (Sun, Vent and Windows), Door Handle and Door Parts, Exterior Light, Relays – Cornering Light, etc.) had mean and standard deviation ranging from 3.36 to 3.52 and .584 to .769 respectively. While all of the six-sub items were rated as highly effective that will integrate the essential competencies outline in table 2.

Item four in table 2 indicated that twelve sub-items five out the twelve sub-item iii, vi, vii, viii and xii are rated a Most relevant with a mean score of 3.60 and a standard deviation ranging from .526 to .606 respectively. While the remaining seven sub-items have a mean ranging from 3.44 to 3.52 and standard deviation ranging from .526 to .606 were rated as highly relevant to integrate the essential competencies outline in table 2. Item five in table 2 above have seven sub-items five out of the seven sub-items had a mean and standard deviation ranging from 3.28 to 3.52 and standard deviation ranging from .538 to .734 respectively.

While the remaining ii and v of the sub-items have a mean of 3.60 were rated as highly relevant to integrate the essential competencies outline in table 2. 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.

While the remaining one of the sub-items have a mean and standard deviation of 3.60 and .587 rated as mostly relevant to integrate the essential competencies outline in table 2. The results presented in the table 2, Item eight above have six sub-items three out of the six sub-items i, iii, iv and v have a mean of 3.60 and a standard deviation ranging .597 to .756 respectively rated as most effective learning outcome that integrate essential competencies in outline in table 2. While the remaining three sub-items ii, iv and v were rated as highly relevant with a mean and standard deviation ranging from 3.44 to 3.52. item nine in above the table 2 have four sub-items, items 1 and 3 have a mean ranging from 3.44 to 3.52 and a standard deviation ranging from .528 to .659 rated as highly relevant learning outcomes that integrate essential competencies outline above in table 1. While the remaining items 2 and 4 have a mean of 3.60 and a standard deviation ranging from .524 ton .646 rated as most relevant learning outcomes that integrate the essential competencies as outline above in table 1. Item ten (10) have four sub-items items 1, 2, and 3 have a mean ranging from 3.36 to 3.52 and standard deviation ranging from .574 to .754 rated as highly relevant learning outcomes that integrate the essential competencies.

While the remaining item 4 has a mean of 3.60 and standard deviation of .688 rated as most relevant learning outcomes as outline in table 1 above. Item eleven (11) have five sub-items item1, 3and 4 have a mean ranging from 3.20 to 3.52 and a standard deviation ranging from .532 to .548 rated as highly relevant learning outcomes. While sub-item 2 and 5 have a mean of 3.60 rated as most relevant learning outcomes that integrate the essential.

#### **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/Fueling 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 repairs and diagnosis of 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 technical college technicians for diagnosis and repairs of Modern Automobile that are required will help lecturers in developing a lesson using the identified competencies that are essentially needed by technical college 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 technical college 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 technical college 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.

## REFERENCES

- [1]. Yahaya and Tijjani (2019). Competency based education and training in technical vocational education: implication for sustainable national security and development. *Journal of Educational Public Research (JEPER)*, 1 (2), 290– 300.
- [2]. Akinola B. and Ogedenga T. (2019). *Basic Automobile Technology* Olajuyin Printer, Akure, Nigeria.
- [3]. Pulson, (2020). Micro, Small, Medium and Large Enterprises Poverty Reduction in Ghana Synthesis of Related literature". *Journal Vol. 5. 2014*.pp 198-199
- [4]. Erjavec, J. (2010). *Automotive technology: A system approach. USA: Cengage Learning Inc.*
- [5]. Federal Republic of Nigeria (2008) *National Policy on Education (NPE, Lagos, NERDC Press, pp, 17-20.*
- [6]. Jalal, A.M. (2019), *Strategies in Place to Rescue Autos Sector*, retrieved from <http://www.autosinsight.com/file/85997/strategies-in-place-to-rescue-autos-sector.html> On 26/08/2010.
- [7]. Krejcie and Morgan, (1970). *Determination of sample size using table.* Kenya Projects Organization Building Capacities.
- [8]. Li, W. (2019). *ABS control on modern vehicle equipped with regenerative braking.* PhD of science thesis in systems and control, delft university of technology, Faculty of Mechanical, Maritime and Materials (3ME), Delft University of Technology.
- [9]. **National Technical Certificate and Advance National Technical**, (2020). **Certificate Curriculum and Modules** Specialization in Vehicle Mechanics Works, Kaduna, NBTE.
- [10]. National Board for Technical Education (2020). **The development of national vocational qualifications framework (NVQF) for Nigeria.** A Report of the national steering committee. NBTE Press.
- [11]. Nworgu, B.G. (2006). **Educational research: Basic issues and methodology.** Nsukka: University Trust Publishers Ltd.
- [12]. NABTEB (2014). **Brochure: Guidelines for admission to courses in Federal / State Technical Colleges in Nigeria.** Benin City, NABTEB, pp. 11-27.
- [13]. Odigiri, A.M. and Ede, E.O. (2010). *Integration of New Technological Innovations in Automobiles into the Curriculum for Nigerian Technical Colleges Programmes.* *Internal Journal of Vocational and Technical Education* 2(5), 89- 94
- [14]. Usman, D.A. (2015). *Human resources development needs of auto technician for effective maintenance of automobiles in Niger State.* An Unpublished M.Ed Thesis, Department of Vocational Teacher Education, University of Nigeria, Nsukka. Vocational Teacher Education, University of Nigeria, Nsukka, pp. 54-68.
- [15]. Yakubu, N. A. (2020). *Identification and assessment of resources requirements in technical and vocational education in Nigeria.* Abuja: F. G. Press.