



Incorporation of Emerging Technologies in Automobile Engines into the Curriculum of Automobile Technology Education Programme in Nigerian Tertiary Institutions

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ABSTRACT

The study determined the emerging technologies in automobile engines needed for incorporation into the curriculum of automobile technology education programmes in Nigerian tertiary institutions. The study was guided by three research questions and three corresponding null hypotheses. The study adopted descriptive survey research design. The instrument for data collection was 18 items structured questionnaire with four-point rating scale on a population of 138 respondents sampled from North Western Nigeria. The questionnaire was validated by five automobile technology education lecturers and the validated instrument was pilot tested in North Eastern region. The reliability of the piloted tested instrument was established to be 0.82 using Cronbach Alpha statistic. Research questions were answered using Mean and Standard Deviation. While One-way analysis of variance (ANOVA) was used to test the null hypotheses at 0.05 level of significance. Findings of the study revealed that all the emerging technologies in the fuel system, ignition system and emission control system were highly needed for incorporation into the curriculum of automobile technology education in Nigerian tertiary institutions. Also, there is no significant difference in the mean responses of the respondents on the emerging technologies in modern automobile engines needed for incorporation into the curriculum of automobile technology education in Nigerian tertiary institutions. The study recommended among others that the identified emerging technologies in modern automobile engines should be incorporated into the curriculum of automobile technology education in Nigerian tertiary institutions.

ARTICLE INFO

Article History

Received: January, 2025

Received in revised form: February, 2025

Accepted: April, 2025

Published online: June, 2025

KEYWORDS

Emerging Technologies, Automobile
Technology Education, Curriculum

INTRODUCTION

Technical Vocational Education and Training (TVET) is globally recognized for its role in preparing people for dynamic engagement in occupations of functional value and an effective source of skilled workforce. TVET is a type of education intended to prepare individuals with competencies in an occupational trade for the technological and economic development of a nation. The Federal Republic of Nigeria [FRN]

(2013) in the National Policy on Education described TVET as a comprehensive term referring to those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life.

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The policy further stated the objectives of TVET to include: providing training for manpower development in applied sciences, technology and business particularly at craft, advanced craft and technical levels; providing technical knowledge and vocational skills necessary for agricultural, commercial and economic development; and give training and impart the necessary skills to individual who shall be self-reliant economically. TVET programmes are offered at both post primary and tertiary educational institutions (Strimel and Grubbs, 2016).

Tertiary institutions are post-secondary institutions focused on learning endeavours in specialized fields of knowledge and skills. They include Universities, Polytechnics, Monotechnics and Colleges of Education. The aims of tertiary institutions in Nigeria are; contributing to national development through high level manpower training, providing high quality career counselling and lifelong learning for self-reliance and the world of work, and reducing skill shortages through production of skilled manpower relevant to the needs of labour market among others (FRN, 2013). Tertiary educational institutions shall pursue these goals through providing a more practical based curriculum relevant to the needs of the labour market. Automobile technology education is one of the professional programmes offered in tertiary institutions in Nigeria.

Automobile technology education is an aspect of technical and vocational education which deals with the construction, maintenance and repairs of motor vehicle. Ismail and Mohammed (2015) consider automobile technology as a programme run at tertiary institution level, and structured to prepare students for the 21st century workplaces in automobile industries. The main aim of automobile technology is to provide high-level skilled graduates who will be facilitators of automobile education in tertiary institutions, entrepreneurs in automobile trades and or gain employment in automobile industries (Ujevbe et al, 2020).

Automobile is an indispensable means of transportation in modern societies. It is a vehicle used for transportation of passengers and goods

on the road and mostly driven by an internal combustion engine. Internal combustion engine is the type of engine in which the burning of fuel takes place inside the engine cylinder. It is the heart of the automobile that converts chemical energy in fuel into mechanical energy that move the vehicle (Sarkar, 2022). Automobile engines are made up of individual systems that work together to produce power. Modern automobile engine systems include: fuel system, ignition systems and emission control system among others.

The main function of the fuel system is to store and supply fuel to the engine and also prepares the air-fuel mixture for the combustion in the cylinder. The ignition system is a primary system of spark ignition engines (petrol engines). It provides the spark necessary to ignite the air-fuel mixture inside the engine for it to burn. The spark must be provided at the correct time and sequence to the various cylinders to produce maximum horsepower with the least amount of fuel thus emitting the lowest number of harmful emissions. Emission control system is used to limit the discharge of poisonous gases from the internal combustion engines. The early vehicle fuel systems were completely mechanical systems delivering fuel using a mechanical fuel pump and a carburettor to atomize and mix the fuel with air. The first automobile ignition system was also mechanical system supplying high voltage using mechanical contact breaker, ignition coil and distributor to the different cylinders.

Today, the designs of modern vehicles have advanced to a very sophisticated level. Unlike the old mechanical operated vehicle systems, modern vehicles are being operated and controlled by computerized electrical sensors (Abdulkadir, Abubakar, Mustapha, Hamidu, Nma & Ayoko, 2022). The modern automobile fuel and ignition systems according to Julian (2015) is electronically controlled and monitored. Harnessing new technologies in automobile engines have made the modern automobiles an assemblage of a group of complicated technologies. Modern automobile engines are controlled by computers and electronic components. Each of these systems require

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Electronic Control Unit (ECU) which reads sensor values from various parts of the engine and depending on these values to performs the appropriate actions. The introduction of electronic controls has particularly brought even greater changes in designs and operations of many automobiles sub-systems.

Emerging technologies can be seen as technologies which arise from new knowledge or the innovative application of existing knowledge leading to the rapid development of new capabilities. According to Vashist and Singh (2013), emerging technologies in automobiles engines include: Variable Valve Timing, Advanced Combustion Modes, Exhaust-Gas Recirculation Systems (EGR), Emission Control System and Drive by Wire Technology among others. To realize the aim of automobile technology education in tertiary institutions, these emerging technologies in modern automobile engines need to be incorporated into the curriculum of automobile technology education.

Curriculum is a set of plans, intentions, activities or outcomes that are delivered in a variety of ways and in different settings. Curriculum in any field of education cannot be separated on the development of knowledge about a particular field, but must simultaneously prepare for productive learners. It is a written guide that involves the teachers' knowledge with learning experiences and resources that can be offered by a society at a given time to the learner (Iwu, 2016). These definitions imply that current needs and future expectations bring about the concept of reviewing the curriculum to accommodate new ideas, skills, knowledge, policies and aspirations of the society. It should reflect the goals, interests and value expectations of the society which is changing fast. The disciplines that are phasing out should be removed and some that are emerging should be given the necessary consideration and added (Umunadi, 2013). Therefore, the emerging technologies in modern automobile engines need to be incorporated into the curriculum of automobile technology education to equip the graduates with the relevant knowledge and skills.

STATEMENT OF THE PROBLEM

The goal of automobile technology education programme in Nigerian tertiary institutions is to provide high-level skilled graduates who will be facilitators of automobile education in secondary and tertiary institutions, entrepreneurs in automobile trades and or gain employment in automobile industries. Automobile technology education graduates have the prospect of either being facilitators of automobile education in schools, set up their own businesses to become self-employed and be able to employ others or employed in industries. Upon graduation, they are expected to possess skills required by automobile industries for employment.

The emergence of new technologies in modern automobiles is a new development and the speed at which it penetrates the work environment is challenging. Emerging technologies is the major issue shaping the global economy and educational system and as such, automobile technology education programme should not be left out. Technological advancement coupled with the emergence of new technologies has however, influenced the modern automobiles (Amaechi and Thomas, 2020). Harnessing new technologies into the vehicles have made the modern automobiles an assemblage of a group of complicated technologies. Nowadays, most automobile systems, such as engines, transmission, braking, steering and suspension systems, are mostly controlled by computers and electronic components.

Umunadi (2013) regrettably reported that most of the graduates of automobile technology education lack the emerging skills required by the automobile industries because most industries spend money in training and retraining the graduates of automobile technology education in Nigeria in order to meet the standard required by the companies and industries, instead of starting work immediately. Nigeria is also characterized with high level unemployment, making majority of graduates including automobile technology education graduates to roam about in search of job.

Okwelle and Beako (2018) maintained that, based on the substantial vehicle population

in Nigeria, it is evident that the maintenance of modern automobiles is still inadequate thereby increasing the prospects of automobile technology education students for effective practice of automobile trade and a successful auto mechanic career. Contrary to this high aspiration, expectation and hope by students to make a good fortune out of the automobile technology education programme, majority of them have been graduating with little skills to enable them secure employment in industries, set up their own businesses or establish self-owned automobile enterprises (Dawha & Medugu, 2016). This situation could be attributed to the deficiency of automobile technology education curriculum as well as insufficient nature of institutional training on modern automobile skills which has equally restricted productivity.

Consequently, the wide spread problem of automobile technology graduates' unemployment and the requirement for graduates to undergo further training before being employed by industries, creates doubts about the relevance of the curriculum. Therefore, this is what prompted the researcher to determine the emerging technologies in modern automobile engines needed for incorporation into the curriculum of automobile technology education in Nigerian tertiary institutions.

Objectives of the Study

The main purpose of this study is to determine the emerging technologies in modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. Specifically, the study intended to determine:

1. Emerging technologies in fuel system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.
2. Emerging technologies in ignition system of modern automobile engines needed for incorporation into the curriculum of automobile technology

education programme in Nigerian tertiary institutions.

3. Emerging technologies in emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

Research Questions

The following research questions were posed and guided the study:

1. What are the emerging technologies in fuel system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.
2. What are the emerging technologies in ignition system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.
3. What are the emerging technologies in emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance to guide in the conduct of the study:

- H₀₁: There is no significant difference in the mean responses of automobile technology education lecturers, technologists and automobile industrial workers on emerging technologies in fuel system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.
- H₀₂: There is no significant difference in the mean responses of automobile technology education lecturers, technologists and



automobile industrial workers on emerging technologies in ignition system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

H₀₃: There is no significant difference in the mean responses of automobile technology education lecturers, technologists and automobile industrial workers on emerging technologies in emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

METHODOLOGY

A descriptive survey research design was used to determine the emerging technologies in modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. Tertiary institutions in the context of this study refer to only the Nigeria Certificate in Education (Technical) awarding institutions. A convenient sampling technique was used to select North Western States of Nigeria as the study areas which are: Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto and Zamfara States because there are good number of tertiary institutions that offer Nigerian Certificate in Education in automobile technology education and functional automobile maintenance companies in this area.

The population of the study was 138 respondents which comprises of 48 automobile technology education lecturers, 21 automobile technologists in all NCE(T) awarding institutions offering NCE(T) in automobile technology

education and 69 automobile industrial workers from selected automobile maintenance workshops registered with Corporate Affairs Commission (CAC) in the study area. Quota Sampling Technique was used to select the automobile maintenance companies in the seven states of northern Nigeria.

18 items structured questionnaire on a 4 - point scale was used to collect data from the respondents. The questionnaire was structured to indicate the extent to which an item is needed as Highly Needed (HN), Moderately Needed (MN), Needed (N), and Not Needed (NN). The response category was assigned numerical values of 4, 3, 2, and 1 respectively. The questionnaire was validated by three automobile technology education lecturers and the reliability of the pilot tested instrument was 0.82 using Cronbach Alpha statistic. Mean and Standard Deviation were used to answer the research questions, items with mean score below 2.50 were regarded as not needed while those with mean score of 2.50 and above were regarded as needed. One-way analysis of variance (ANOVA) was used to test the null hypotheses at 0.05 level of significance. If P-Value is equal or less than the alpha value of 0.05, the null hypotheses were rejected and where the p-value is greater than the alpha value of 0.05 the null hypotheses were retained.

RESULTS

Research Question 1:

What are the emerging technologies in fuel system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

Table 1: Mean and standard deviation of the respondents on the emerging technologies in fuel system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions N = 138

S/N	Item Statements	\bar{X}	SD	Decision
1	Electronic Fuel Injection System (EFI) Technology	3.49	0.51	Needed
2	Gasoline Direct Injection System (GDI) Technology	3.47	0.50	Needed
3	Direct Mixture Injection System Technology	3.48	0.55	Needed
4	Air-Assisted Direct Fuel Injection System Technology	3.30	0.53	Needed

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S/N	Item Statements	\bar{X}	SD	Decision
5	Electronic Control Carburettor Technology	3.49	0.54	Needed
6	Common Rail Fuel Injection System Technology	3.20	0.66	Needed
Grand Mean		3.41	0.55	

The results presented in Table 1 revealed that the mean scores of the items range from 3.20 to 3.49. This is applicable to the grand mean score of 3.41 and standard deviation value of 0.55. The grand mean suggests that the emerging technologies in fuel system of modern automobile engines are needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. The Table also revealed that the standard deviation of the items ranges between 0.50 and 0.66. This showed that the respondents

were not far away from each other in their opinions.

Hypothesis One:

There is no significant difference in the mean responses of automobile technology education lecturers, technologists and automobile industrial workers on emerging technologies in fuel system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

Table 2: Analysis Variance used for testing the difference in the Responses of Automobile Technology Education Lecturers, Technologists and Automobile Industrial Workers on the emerging technologies in fuel system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.119	2	.059	.327	.722
Within Groups	21.286	135	.182		
Total	21.405	137			

The results of analysis of variance (ANOVA) presented in Table 2 revealed that the Sum of Squares of 0.119 and 21.286 for Between Groups and Within Groups at degree of freedom (df) of 2 and 117 respectively. The F-value obtained is 0.327 and the p-value is greater than the level of significance ($0.722 > 0.05$). The result therefore shows that there is no significant difference in the mean responses of automobile technology education lecturers, technologists and automobile industrial workers on the emerging technologies in fuel system of modern automobile

engines needed for incorporation into the curriculum of automobile technology education in Nigerian tertiary institutions. Therefore, the null hypothesis was upheld.

Research Question 2:

What are the emerging technologies in ignition system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

Table 3: Mean and standard deviation of the respondents on the emerging technologies in ignition system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions N = 138

S/N	Item Statements	\bar{X}	SD	Decision
7	Electronic Control Ignition System Technology	3.48	0.77	Needed
8	Knock Sensing Technology	3.13	0.80	Needed
9	Variable Valve Timing (VVT) Technology	2.98	0.95	Needed

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S/N	Item Statements	\bar{X}	SD	Decision
10	Coil-On-Plug Ignition System Technology	3.13	0.67	Needed
11	Distributorless Ignition Systems (DIS) Technology	3.18	0.77	Needed
12	Variable Compression Ratio Engines Technology	3.35	0.60	Needed
Grand Mean		3.21	0.76	

The results presented in table 3 showed the analysis of items used to answer research question two. All the items have mean scores ranging from 2.98 to 3.48 and a grand mean score of 3.21 and standard deviation value of 0.76. This indicated that emerging technologies in ignition system of modern automobile engines are needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. Moreover, the table has shown that the standard deviation of the items ranges between 0.60 and 0.95. This disclosed that the

respondents were not far away from one other in their views.

Hypothesis Two:

There is no significant difference in the mean responses of automobile technology education lecturers, technologists and automobile industrial workers on emerging technologies in ignition system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

Table 4: Analysis Variance used for testing the difference in the Responses of Automobile Technology Education Lecturers, Technologies and Automobile Industrial Workers on the emerging technologies in ignition system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.074	2	.037	.114	.892
Within Groups	37.718	135	.322		
Total	37.792	137			

Table 4 showed the results of analysis of variance (ANOVA). The Sum of Squares was 0.074 and 37.718 for Between Groups and Within Groups at degree of freedom (df) of 2 and 117 respectively. The F-value obtained is 0.114 and the p-value is greater than the level of significance ($0.89 > 0.05$). This implies that there is no significant difference in the mean responses of automobile technology education lecturers, technologists and automobile industrial workers on the emerging technologies in ignition system of modern automobile engines needed for

incorporation into the curriculum of automobile technology education in Nigerian tertiary institutions. Hence, the null hypothesis was maintained.

Research Question Three:

What are the emerging technologies in emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

Table 5: Mean and standard deviation of the respondents on the emerging technologies in emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions N = 138

S/N	Item Statements	\bar{X}	SD	Decision
13	Emission Control System Technology	3.33	0.74	Needed
14	Exhaust Gas Recirculation (EGR) Technology	3.41	0.68	Needed

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S/N	Item Statements	\bar{X}	SD	Decision
15	Catalytic Converter Technology	3.37	0.77	Needed
16	Positive Crankcase Ventilation System (PCV) Technology	3.38	0.66	Needed
17	Turbocharging System Technology	3.35	0.69	Needed
18	Evaporative (EVAP) Emission Control System Technology	3.31	0.79	Needed
Grand Mean		3.36	0.70	

Table 5 presents the results of the items used to answer research question five. From the result, the mean scores of the items range from 3.31 to 3.41 with a grand mean score of 3.36 and standard deviation value of 0.70. This showed that the emerging technologies in emission control system of modern automobile engines are needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. The result also revealed that the standard deviation of the items ranges between 0.66 and 0.79. This implies that the

respondents were not far away from each other in their opinions.

Hypothesis Three:

There is no significant difference in the mean responses of automobile technology education lecturers, technologists and automobile industrial workers on emerging technologies in emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions.

Table 6: Analysis of Variance used for testing the difference in the Responses of Automobile Technology Education Lecturers, Technologies and Automobile Industrial Workers on the emerging technologies in emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.062	2	.031	.081	.922
Within Groups	44.808	135	.383		
Total	44.869	137			

The results of analysis of variance (ANOVA) presented in Table 6 showed that the Sum of Squares of 0.062 and 44.808 for Between Groups and Within Groups at degree of freedom (df) of 2 and 117 respectively. The F-value obtained is 0.081 and the p-value is greater than the level of significance ($0.922 > 0.05$). The result therefore indicated that there is no significant difference in the mean responses of automobile technology education lecturers, technologists and automobile industrial workers on the emerging technologies in emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education in Nigerian tertiary institutions. Consequently, the null hypothesis was upheld.

DISCUSSION OF FINDINGS

The findings in Table 1 relating to research question one showed that the respondents agreed with all the items on the emerging technologies in fuel system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. The technologies include: electronic fuel injection system (EFI), gasoline direct injection system (GDI), direct mixture injection system, air-assisted direct fuel injection system, electronic control carburettor and common rail fuel injection system. To buttress this finding, Abdulkadir, Abubakar, Mustapha, Hamidu, Nma and Ayoko (2022) stated that the emerging technologies competencies needed by motor vehicle mechanics students in the maintenance of fuel systems for the



establishment of automobile enterprises include but not limited to competencies in servicing electronic fuel injection system (EFI), electronic control carburettor and common rail fuel injection system. Also, Beako (2017) noted that majority of the fuel system of modern automobile engines now come with electronic fuel injection system (EFI) to control the mixture strength in the fuel supply system. Similarly, Mohammed (2018) opined that the principles of operation of electronic fuel injection (EFI), electronic carburettor and dual fuel system are highly needed for inclusion in the minimum standards for Nigeria Certificate in Education (NCE) in automobile technology.

The findings in table 2 relating to hypothesis one revealed that there is no significant difference in the mean responses of the respondents on the emerging technologies in fuel system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. This was supported by Abdulkadir et al (2022) who asserted that there was no significant difference between the mean response of motor vehicle mechanics and automobile industrial technicians on maintenance of fuel systems for establishing automobile enterprises in FCT, Abuja. Correspondingly, Mohammed (2018) declared that there is no significant difference in the mean responses of Automobile Industrial Supervisors and Automobile Technology Lecturers on the new contents of fuel system of automobile for inclusion in the minimum standards for Nigeria Certificate in Education (NCE) in automobile technology.

The results presented in table 3 involving research question two revealed the emerging technologies in ignition system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. These include: electronic control ignition system, knock sensing, variable valve timing (VVT), coil-on-plug ignition system, distributorless ignition systems (DIS) and variable compression ratio engines technologies. This is in agreement with the work of Olayinka and Oyenuga (2010) who emphasised that the ignition

system of modern automobiles has also witnessed changes from conventional point type with a magnetic pick-up coil to electronic ignition system. To buttress this finding, Mohammed (2018) asserted that electronic ignition system is needed for inclusion in the minimum standards for Nigeria Certificate in Education (NCE) in automobile technology. Furthermore, Okwelle, Beako and Ajie (2017) stated that replacing faulty electronic ignition components is one of the technical skills required by motor vehicle mechanic artisans in repairing and maintaining the ignition system which would guarantee the establishment of standard motor vehicle mechanic enterprise that will provide solutions to various mechanical faults of motor vehicles operating.

Also, the result in table 4 concerning hypothesis two discovered that there is no significant difference in the mean responses of the respondents on the emerging technologies in ignition system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. This is in agreement with the findings of Ariyo, Udogu and Mamman (2021) who stated that there was no significant difference between the mean responses of automobile teachers and automobile craftsmen on the mechatronics sub-systems that should be integrated into the curriculum of automobile in technical colleges.

The results presented in table 5 involving research question three showed the emerging technologies in emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. These include among others: Positive Crankcase Ventilation System (PCV) Technology, Catalytic Converter Technology and Evaporative (EVAP) Emission Control System Technology. The result is supported by William (2017) who noted that computerized engine control systems regulate air and fuel delivery, emission systems operation and a host of other related operations. It therefore becomes necessary for technical colleges to equip Motor Vehicle Mechanics Works students with practical

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skills in basic computer operations and applications for them to perform their functions effectively and efficiently in any organization by using computer to troubleshoot and detect vehicle faults. Olayinka and Oyenuga (2010) also declared that the practical contents of the new technological developments in automobile to be integrated into curriculum of the motor vehicle mechanic work program in the technical colleges include diagnose of emission control system and determine needed repairs.

Likewise, the result in table 6 concerning hypothesis five discovered that there is no significant difference in the mean responses of the respondents on the emerging technologies in emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education programme in Nigerian tertiary institutions. To buttress this finding, Ariyo Udogu and Mamman (2021) stated that there was no significant difference between the mean responses of teachers and automobile craftsmen on the mechatronics sub-systems (emission control system inclusive) needed for integration into the automobile curriculum of technical colleges.

CONCLUSION

This study determined the emerging technologies in fuel system, ignition system and emission control system of modern automobile engines needed for incorporation into the curriculum of automobile technology education in Nigerian tertiary institutions. Based on the findings from the study it was concluded that all the emerging technology technologies in the fuel system, ignition system and emission control system were highly needed for incorporation into the curriculum of automobile technology education in Nigerian tertiary institutions. Accordingly, if the findings of this study are effectively utilized a batch of high-level skilled graduates who will be facilitators of automobile education in secondary and tertiary institutions, entrepreneurs in automobile trades and or gain employment in automobile industries will be produced.

RECOMMENDATIONS

Based on the findings and conclusion from this study, the following recommendations were made:

1. The identified emerging technologies in modern automobile engines should be incorporated into the curriculum of automobile technology education in Nigerian tertiary institutions.
2. The curriculum for training automobile technology education instructors should be reviewed to include emerging technologies in modern automobile engines in order to prepare lecturers and technologist who will be able to implement the curriculum with the new contents for the Nigerian tertiary institutions.
3. Federal Government of Nigeria, Automobile manufacturers and industries should collaborate with educational institutions to organize skill improvement training programmes for automobile technology education lecturers and technologies on the identified emerging technologies in modern automobile engines.

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