

**INTEGRATION OF NEW TECHNOLOGICAL  
DEVELOPMENTS INTO TECHNICAL COLLEGE AUTO-  
MECHANICS COURSE CURRICULUM FOR  
ENHANCING JOB READINESS OF AUTOMOTIVE  
STUDENTS**

**Abdul Latib\***

**A. B. Inti, M.M\***

**Ahmad, A.D. \***

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### **Abstract**

This research was carried out with the aim of investigating into new technological developments in automotive technology that are important to be integrated into the present curriculum of auto-mechanics work at technical college level. Three (3) research questions were answered and the findings of this study represent the opinions of major stakeholders in the automotive sector and education in Nigeria. Findings of the study indicates that all the identified new technological innovations have implication for the works of today's automobile maintenance personnel. The design adopted for this study was survey research design and the area of the study covers two states from north-eastern part of Nigeria, these are Bauchi and Gombe States. The population used was automobile technology teachers and automobile workshop supervisors. A simple random sampling was adopted in selecting four technical colleges and five workshops from each state and the total no. of thirty two (32) respondents were used for the study which comprised of twenty two (22) auto-mechanic teachers and ten (10) supervisors. A semi-structured questionnaire containing 33 items which was validated by 5 experts in automobile technology

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\* Faculty of Education, Universiti Teknologi, Malaysia (UTM), Skudai Campus, Johor Bahru, Darul Ta'azim Malaysia

was used to collect data from the respondents. The data collected for the study was analyzed using mean and standard deviation.

**Key Terms:** Integration of New Technological Developments, Technical College, Auto mechanic Course, Auto Mechanics Curriculum, Job Readiness and Auto Mechanics Students

## Introduction

In Nigeria, technical colleges train and produce craftsmen, master craftsmen, artisans and technicians for different trades in order to make them self-employed or secure jobs into relevant industries for various sectors of the economy, and these colleges are regarded as the principal vocational institutions. The technical colleges offer various mechanical trades among is motor vehicle mechanics trade. Motor Vehicle Mechanics like other forms of technical trades all over the world has been expanding at an accelerating rate in the last three decades. The expansion in the production of Modern Automobiles and demand for higher quality has created a need in the automotive industry for workers with higher levels of skills and knowledge (Inti, 2009). The programme of motor vehicle mechanics in Nigerian technical colleges is designed to produce competent auto-mechanics craftsmen for Nigerian technological and industrial development. According to National Board for technical Education (NBTE, 2001.), auto-mechanic craftsmen are expected to test, diagnose, service and completely repair any fault on the motor vehicle to the manufactures specification. For this to be achieved, a national curriculum is used by all technical colleges that are accredited by National Board for Technical Education (NBTE) which the statutory body mandated with the task of accreditation of all vocational training programmes outside university circle.

Automobile is a generic term for a self propelled, trackless, non-articulated, four – wheeled land vehicle which encompasses passenger cars, recreational vehicles, taxis and buses used to transport people in cities, on highways or across countries (Obrist, 1989; Anglin, 1997). The curriculum for motor vehicle mechanic work in the technical colleges is developed to offer a complete secondary school education in general education in addition to occupational areas, while the central purpose of motor vehicle mechanic work trade is to provide its recipients with the skills required for self-employment as well as jobs in the automobile industries (Olayinka and

Oyenuga, 2010). The incorporation of new technologies with new sub-systems and systems components into modern automobiles have changed their configuration and made their maintenance a more complex task, even though some of the new systems make them easier to maintain.

With technological advancements, computers are used to control apparently most systems and operations in modern automobiles. Apart from the carburetor that has been replaced by electronic injection system, the ignition system has also undergone changes from the conventional point type with a magnetic pick-up coil to electronic ignition system. When going back through historical lane at the early stage of development, there were several experimental cars but the work of Karl Benz, a German mechanic in 1885 was regarded as the first practical and reliable automobile (Wilkins, 1971; Clarke, 1978). The Benz car and many other early automobiles were however, simple, not very reliable, limited in speed and distance of travel and less comfortable. Technological dynamism as stated earlier coupled with emergence of new technologies has however influenced the modern automobiles. There has been a continual evolution in designs intended to achieve faster, more reliable, more streamlined, cleaner and safer vehicle with enhanced comfort, fuel economy and longevity.

New technologies that have been incorporated into the modern automobiles have made the modern motor vehicle an assemblage of a group of more delicate and complicated technologies. In a nut shell, technological development has brought several changes and modifications in automobile systems that are imported or assembled in this Nigeria. With all these advancements in technology and the introduction of new sophisticated system into automobiles, several studies conducted all revealed that the products of Nigerian technical colleges who graduated from auto-mechanic trade lack the basic skills needed for gainful employment in today's automobile industries (Jimoh, 1997; Elobuike, 1999; Anbata, 2000, Inti, 2009). The curriculum was blamed for not being adequate and relevant to offer enough of the skills needed to meet the challenges that are involved in the maintenance of modern automobiles on Nigerian roads.

The gap created between the curriculum and the new technological innovations is very wide that the graduates of these programmes are often unemployed or under-employed, while most of the vehicles with these new systems suffer from disrepair (Inti, 2009). If the system of these new brands of automobiles are not integrated into the learning content of programmes for

training the automobile craftsmen, the transport sector of this country together with the auto-mechanics will suffer a great deal of setback in this modern world.

### **Purpose of the Study**

The purpose of this study is to look into the new technological innovations in the field of automobile, identify those that are important to be integrated into the technical colleges' automobile curriculum. As the entire world is moving towards greater technological advancement together with automobile industries and so shall the curriculum for the training of automobile craftsmen. Specifically the study identified:-

1. The theoretical contents of the new technological developments in automobile that are important to be integrated into technical college auto-mechanics course curriculum for enhancing Job Readiness of automotive Students.
2. The practical contents of the new technological developments in automobile that are important to be integrated into technical college auto-mechanics course curriculum for enhancing Job Readiness of automotive Students.
3. The tools, materials, machines and equipment required for training in the new content area.

### **Research Questions**

1. What are the theoretical contents of the new technology developments in automobile that are important to be integrated into technical college auto-mechanics course curriculum for enhancing Job Readiness of automotive Students ?
2. What are the practical contents of the new technology developments in automobile that are important to be integrated into technical college auto-mechanics course curriculum for enhancing Job Readiness of automotive Students?
3. What are the tools, materials, machines and equipment required for training of automotive students in the new content area?

## Methodology

The design adopted for this study was survey research design and the area of the study covers two states from north-eastern part of Nigeria, these are Bauchi and Gombe States. The population used was automobile technology teachers and automobile workshop supervisors. A simple random sampling technique was adopted in selecting four technical colleges and five workshops from each state and the total no. of thirty two (32) respondents were used for the study which comprised of twenty two (22) auto-mechanic teachers and ten (10) workshop/industrial based supervisors. A semi-structured questionnaire containing 33 items which was validated by 5 specialist in the area of automotive technology for face and content validity to ensure effectiveness of the items was used to collect data from the respondents. The data collected for the study was analyzed using mean and standard deviation.

## Results

### 4.2.1 Research Question 1

1. What are the theoretical contents of the new technology developments in automobile that are important to be integrated into technical college auto-mechanics course curriculum for enhancing Job Readiness of automotive Students ?

The data collected from auto-mechanics teachers and automobile workshop/industrial supervisors were analyzed using mean and standard deviation.

**Table 1: Mean Responses of Technical Teachers and Automobile Workshop Supervisors on theoretical contents of technological developments in automobile that are important to be integrated into the technical college auto-mechanics course curriculum:**

S/N	ITEMS	MEAN X	S.D	REMARK
1.	Engine performance testing (power, torque, efficiency, etc)	3.63	0.59	Important
2.	Types, design and principle of operation of Electronic fuel injection	3.40	0.55	Important
3.	Types, design and principle of operation of All Wheel Drive (AWD) system	3.56	0.56	Important
4.	Types, design and principle of operation of All Wheel Steering (AWS) system	3.34	0.59	Important
5.	Principle of operations, installation and reactivation of Safety air bag and curtain	3.40	0.61	Important
6.	Principle of operations, installation and reactivation of Safety air bag and curtain	2.96	0.92	Important
7.	Sensors and sensed systems of motor vehicle (sensor types, principles and characteristics)	3.00	0.75	Important
8.	Electronic ignition system; design and principle of operation	3.40	0.55	Important
9.	Anti-lock braking system (ABS); principle of operation and types	3.09	0.58	Important
10.	Electronic carburetor; design and operation	3.37	0.65	Important
11.	Actuators and micro- controls ; types, functions, and principles	3.12	0.78	Important
12.	Hybrid vehicles (electric and fuel-cell powered) power systems and transmission	3.25	0.97	Important

The data presented in table 1 indicate that item 1, engine performance testing (power, torque, efficiency, etc) has the highest mean rating of 3.36. item 6, safety air bag and curtains: principle of operation, installation, reactivation, etc possess the least mean rating of 2.96. it can be clearly seen that the analysis of this research question showed an indication that the mean responses of automobile technology teachers and automobile workshop supervisors to all the items are still greater than 2.50. This implies that all the items in table 1 were rated as important theoretical contents of technological developments in automobile to be integrated into the curriculum of auto-mechanics work programme in the technical colleges. Therefore, all the items were important.

#### Research Question 2

What are the practical contents of the new technology developments in automobile that are important to be integrated into technical college auto-mechanics course curriculum for enhancing Job Readiness of automotive Students ?

The data collected from auto-mechanics teachers and automobile workshop/industrial supervisors were analyzed using mean and standard deviation.

**Table 2: mean responses of technical teachers and automobile workshop supervisors on practical contents of technological developments in automobile that are important to be integrated into technical college auto-mechanics course curriculum**

S/N	ITEMS	X	S.D	REMARK
13.	Conduct engine performance test and determine needed repair	3.56	0.66	Important
14.	Inspect, repair or replace electronic ignition components	2.50	1.06	Important
15.	Perform on board computer diagnosis on Electric Control Unit (ECU) brain box	3.66	0.59	Important
16.	Determining engine performance using engine analyzer and detecting needed repair	3.56	0.50	Important
17.	Emission control system diagnosis and needed repairs determination	2.84	0.71	Important
18.	Installation, reactivation or replacement of deployed air bags	3.00	0.75	Important
19.	Diagnosis of All Wheel Drive (AWD) system and determining needed repairs	3.59	0.49	Important
20.	All Wheel Steering (AWS) system: replace or repair according to manufacturers specification	3.53	0.50	Important
21.	Check operation of anti-lock braking system (ABS): adjust or repair according to manufacturers specification	3.31	0.53	Important
22.	Perform oil and lubrication service on normally aspirated and turbo-charged engines	2.96	0.67	Important

The data presented in table 2 showed that item 15, perform on board computer diagnosis on Electric Control Unit (brain box) has the highest mean rating of 3.66. Item 14, inspect, repair or replace electronic ignition component has the least mean rating of 2.50. It can be observed that the analysis of this research question showed an indication that the mean responses of automobile technology teachers and automobile workshop supervisors to all the items are still

greater than or equal to 2.50. This implies that all the items in table 2 were rated as important theoretical contents of technological developments in automobile to be integrated into the into technical college auto-mechanics course curriculum.. Therefore, all the items were important.

### Research Question 3

What are the tools, materials, machines and equipment needed for training of Auto mechanics in the new subject area?

The data collected from teachers of auto-mechanics course at technical college level and automobile workshop supervisors were analyzed using mean and standard deviation.

**Table 3: mean responses of technical teachers and automobile workshop supervisors on tools, materials, machine and equipment needed for training in the new content areas in automobile that are important to be integrated into technical college auto-mechanics course curriculum**

S/N	ITEMS	X	S.D	REMARK
23.	Digital engine analyzer	3.69	0.50	Important
24.	Virtual test tracker	2.46	1.06	Less important
25.	Super-automatic tyre changer	3.15	0.75	Important
26.	Digital chassis dynamometer	3.22	0.70	Important
27.	Steering geometry and alignment gauges	3.34	0.64	Important
28.	Micro-processor controlled brake analyzer	3.31	0.58	Important
29.	Fuel injector tester and cleaning equipment	3.78	0.41	Important
30.	Electronic Control Unit (ECU) analyzer	3.78	0.54	Important
31.	Trolley type (hydraulic) lifting jack	2.88	0.99	Important

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32.	Pedal force transducer with digital and barograph indication	3.03	0.64	Important
33.	High pressure washing equipment	2.25	1.16	Less important

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The result of data presented in table 3 indicate that items 29 and 30, fuel injector tester and cleaning equipment, electronic control unit (ECU) analyzer have the highest mean rating of 3.78 each. While Items 24 and 33, virtual test tracker, and high pressure washing equipment have the least mean rating of 2.46 and 2.25 respectively. It can be observed that the analysis of this research question showed an indication that the mean responses of automobile technology teachers and automobile workshop supervisors to items 24 and 33 are less than the mean average as such items 24 and 33 are considered less important. While the rest of the items having satisfied the required mean average to be considered important, that is they are still greater than 2.50. This implies that items 23, 25, 26, 27, 28, 29, 30, 31, 32, in table 2 were rated as important tools, equipment and machines needed for training in the new content areas in automobile that are important to be integrated into the technical college auto-mechanics course curriculum. Therefore, two (2) of the items were less important while the rest were considered important.

### Findings of the Study

The findings of the study are as follows:

- i. In the finding of the theoretical contents of the technological developments in automobile to be integrated into technical college auto-mechanics course curriculum. All the items under this research question were considered important to be integrated into the present auto-mechanics work curriculum of the technical colleges.
- ii. Based on the analysis that was carried out in view of the practical contents of the technological developments in automobile to be integrated into the technical college auto-mechanics course curriculum. It was found that all the items under this research question were accepted as important to be integrated into the present auto-mechanics work curriculum of the technical colleges.

iii. After conducting analysis on the data collected during this research work, two (2) items, 24 and 33, virtual test tracker and high pressure washing machine respectively all under tools, equipment and machine needed for training in the new content area were found less important to be integrated into the present technical college auto-mechanics course curriculum. While the rest were considered important.

#### 4.4 Discussions of Findings

The data presented in table 1, provided answers to research question one. The result revealed that all the twelve theoretical contents of the technological developments in automobile were rated important to be integrated into the curriculum of motor vehicle mechanics work program in the technical colleges. The acceptance of all the identified new theoretical contents of the technological developments in automobiles by both the automobile industries workshop supervisors and technical teachers of auto-mechanics as important to be integrated into the curriculum of motor vehicle mechanics work program in the technical colleges is ideal and in agreement with the present state of technological development. The result is a pointer that challenges in the motor vehicle mechanics work curriculum must be responsive in order to maintain its relevance in the dynamic world of work. This result is in line with assertion of Olaitan (1996) that various production tasks which were manually performed have become mechanized and in some cases, these are automated with computer technology.

Schwaller (1993) and Nice (2001) both agreed that the incorporation of new technologies in modern automobiles make vehicles more complex, though some of the new technologies make automobile vehicles easier to service. Schwaller (1993) insisted that service personnel needs not only the understanding of the parts, nomenclature and operation but also requires great deal of knowledge and skills in the selection and correct application of tools, correct procedures of fault diagnosis, disassembling and reassembling. Meeting these requirements must come from the identification of the relevant technologies and covering all their relevant components in motor vehicle mechanics work curriculum.

The underlying principles of electronic controls of automotive systems according to Bezdek (1992) are in fuzzy sets and fuzzy logic systems. Sensors are however said to be the

primary feeders of these systems. The introduction of mechatronics components particularly addressed these basics. It is also reflected in curriculum for similar programs in Japan (Murata and Stern, 2002). In line with Awokoya (1981) that the characteristics of a quality education program should include relevance, adaptability and international link among others. The new contents of the curriculum in addition to providing the necessary technical base will also help to bridge the gap in international standards.

In accordance with the practical contents regarded as important by the respondents, the data presented in table 2 provided answers to research question two. Table 2 revealed that all the ten (10) practical contents of the technological developments in automobile are important to be integrated into the motor vehicle mechanics work curriculum of the technical colleges. This result indicated that acquisition of basic practical skill on test, diagnose, service and repair are required for the new changes in automobile mechanic work in automobile industries. Okoro (1999) writing on the need for production of skilled auto-mechanics explained that a well-trained motor mechanic would be able to diagnose and repair automobile faults quickly and accurately.

In Table 3, The result of data presented in table 3 indicate that items 29 and 30, fuel injector tester and cleaning equipment, electronic control unit (ECU) analyzer have the highest mean rating of 3.78 each. While Items 24 and 33, virtual test tracker, and high pressure washing equipment have the least mean rating of 2.46 and 2.25 respectively. it can be observed that the analysis of this research question showed an indication that the mean responses of automobile technology teachers and automobile workshop supervisors to items 24 and 33 are less than the mean average as such items 24 and 33 are considered less important. While the rest of the items having satisfied the required mean average to be considered important, that is they are still greater than 2.50. This implies that items 23, 25, 26, 27, 28, 29, 30, 31, 32, in table 2 were rated as important tools, equipment and machines needed for training in the new content areas in automobile that are important to be integrated into the technical college auto-mechanics course curriculum. Therefore, two (2) of the items were less important while the rest were considered important. The result of this finding is in the accordance with (Inti, 2009) that the use of outdated and obsolete equipment in training affects the level of job performance of the graduates. This is also in agreement with one of the principles of vocational education that effective vocational and technical training can only be given where the training jobs are carried out in the same way, with

the same operations, the same tools, the same machines and equipment as in the occupation itself.

Each and every new curriculum supposes to have validity for limited duration. From this view point, Pratt (1991) likened the curriculum to open systems that maintain their equilibrium by monitoring their own internal states and making adjustments to adapt to destabilizing perturbations. Pratt further emphasized that curriculum and instruction can be conceptualized as open systems interacting with the environment and maintaining equilibrium by transformation of energy and exchange of information among the component sub-systems. In the same viewpoint, work, skills and training can be conceptualized as sub-systems of an open system; then new innovations and changes in technology demands new work skills being the common perturbations that often destabilize the contents of school curricula and instructional activities. There must therefore be a continuous interaction and exchange of information between the schools and industries where the new innovations and changes in technology are emanating from. The findings of this study represent the opinions of major stakeholders in the automotive technology development and education in Nigeria. It shows that all the identified new technological innovations have implications for the works of today's automobile maintenance personnel.

### **Conclusion**

The study has identified the theoretical and practical contents that are important to be integrated the new technological developments in automobile and at the same time integrate the theoretical and practical contents identified into existing modules of the motor vehicle mechanics work curriculum of technical colleges in Nigeria. It is hoped that if all these theoretical and practical contents are taken into consideration in the training of auto-mechanics craftsmen in the technical colleges, the students will graduate from the technical colleges with the knowledge and practical skills required to meet the needs of the industry and evolving technological developments in the automobile industries. Consequently, the students will be able to face the challenges of work in the automobile industry if employed, establish their own workshop in the absence of paid employment, become employers of labour instead of depending solely on paid employment and thereby contribute their own quota to the industrial development of Nigeria and the world at large.

### Recommendations

Based on the findings of this study, the following recommendations are made:

- i. Motor vehicle mechanic teachers should be allowed to go for refresher courses/workshop in the automobile industry to update their practical skills.
- ii. The regulatory agency of technical education in Nigeria, the National Board for Technical Education (NBTE) should conduct a review of curriculum for motor vehicle mechanics work programs in technical colleges with a view to include the new theoretical and practical contents for studying the new technological developments in automobiles.
- iii. Government and Administrators of technical colleges in Nigeria should ensure the provision of adequate workshop and equipment for an effective implementation of the curriculum to be reviewed.
- iv. The teaching staff (teachers/instructors) should undergo appropriate retraining to update their knowledge and skills for effective implementation of the new curriculum.
- v. Constant seminars, workshops and conferences should be organized for technical college teachers/instructors and students to keep them abreast of the new developments in automobile.

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