# Technological Skills Requisite by Motor Vehicle Mechanics Trainees of Technical Colleges for Optimal Productivity and Sustainability in Ogun State, Nigeria

*Olusiji Olaseni Lemo*[*]

***Abstract***

Motor vehicle mechanics trainees who generally enjoyed the regular flow of customers for effective maintenance and repairs of conventional vehicles are now faced with the challenges of diagnosing and servicing modern vehicles. This prompts the study to examine the technological skills requisite by motor vehicle mechanics (MVM) trainees of technical colleges for optimal productivity and sustainability in Ogun State Nigeria. Two research questions and two null hypotheses guided the study. The study employed descriptive survey research design. Three hundred and fifty-four professionals comprising of 28 MVM teachers in nine technical colleges and 326 registered automobile industrial technicians in Ogun State constituted the study population. Total enumeration was used to select all the 28 MVM teachers because of manageable size while proportionate stratified random sampling techniques was used to select 89 registered automobile industrial technicians in Ogun State as study sample. The instrument used for data collection was 17-item structured questionnaire which was designed on a modified 4-point Likert scale titled 'Technology Skills Requisite Trainees Questionnaire (TSRTQ). The instrument was face and content validated by three research experts from Department of Industrial Technical Education, Tai Solarin University of Education, Ijagun. 0.86 reliability co-efficient (r) value was obtained through Cronbach's Alpha coefficient. 117 copies of the questionnaire were retrieved by the researcher with the help of three research assistants. Mean and standard deviation was used to analyse the research questions while t-test was used to test the hypotheses. It was found out that it is essential for trainees to be

[*] Department of Industrial Technical Education,
College of Vocational and Technology Education,
Tai Solarin University of Education, Ijagun
rossandlemo@yahoo.co.uk

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equipped with the skills in handling modern diagnostic equipment to perform On-Board Diagnoses and servicing electronics control units (ECUs) in motor vehicle. Therefore, it was recommended that curriculum planners and policy makers should ensure that MVM curriculum is reviewed to incorporate technological skills requisite in motor vehicle industry to enable trainees' suite in and enhance their sustainable development upon graduation.

*Keywords:* Motor vehicle mechanics trainees, Productivity, Sustainability and Technological skills,

## Background to the Study

It is no longer a news that every sector of life has experienced a vast change as a result of technology development. Automobile industry is one of the most significant sectors which have become more technologically advanced with the way modern vehicles are designed based on computerized system. Therefore, the survival of this industry lies on several factors which are not limited to competent workforce group who can adequately understand the system working principle among which are trainees of motor vehicle mechanic of technical colleges. Technical college is a post-primary institution in Nigeria which is established to offer vocational and technical education programmes. This educational institution is selectively established to train and equip students with requisite technical skills and competences for earning a living. Students exposed to technical school educational training are provided with requisite basic scientific knowledge, practical skills and work-related attitudes as craftsmen and as technicians at sub-professional level (Umar, 2016). The institution is basically saddled with the responsibilities of producing qualified skill personnel for specific career lines, trades and special areas such as motor vehicle mechanic (MVM) for meeting engineering-based needs of the immediate society.

Motor vehicle mechanic (MVM) is one of the mechanical engineering trades offered in technical colleges which involve the acquisition of scientific knowledge in design, selection of materials, construction, operation and maintenance of motor vehicles. MVM work trade at the technical college consists of three components grouped as service station mechanic work, engine maintenance and refurbishing and auto-electricity. Abubakar and Abutu (2019) described MVM trainee as a person who, for compensation, engages in the diagnosis or repair of faulty motor vehicles components or systems. This means that motor vehicle mechanic trainees are

responsible for the service and repair of motor vehicles including undertaking work on engine and electronics control units (ECUs) in motor vehicle. However, for trainees to achieve an optimum productivity in the above aforementioned task it is essential that they are adequately equipped with the requisite technological skills needed in bridging the gap between what is learnt in college and required in the industry.

Diagnosing faults in motor vehicle engine and its support system involves a thorough understanding of how the interrelated systems in a vehicle function. This knowledge can be referred to as the technological skills posited by Abubakar and Abutu (2019) and Adeniran et al. (2024) to include ability to conduct engine testing, examination, inspection to engine performance for wear such as lubrication system, ignition system, fuel system, cooling system and starter circuit components. In addition, Abdulkadir, et al. (2022) and Thomas et al. (2023) outlined some required technological skills in diagnosing faults to include; ability to conduct engine performance test using engine analyser, ability to distinguish abnormal sounds in the engine and localize such sounds to specific components or systems, ability to determine confidently needed repairs on components and systems being diagnosed. Automotive vehicles are nowadays equipped with a significant number of networks of electronics systems by which advanced vehicle control, elimination of bulky wiring and sophisticated features are achieved. Most of the features are enabled by the use of distributed electronic systems including sensors, switches, actuators and electronics control units (ECUs) (Isaac, 2015).

In a study, Adeniran et al. (2024) found that current technical abilities in the repair of ignition systems, carburettors, including wheel balancing and alignment, are necessary for automobile mechanical apprentices to graduate as artisans and build a quality automobile mechanical firm. Similarly, Thomas et al. (2023) recorded that automobile engineering graduates needed improvement in skills areas for servicing, diagnosing faults, repairing faults on hybrid car engines and support systems. Therefore, a sound technological skill is essential for optimum productivity as it provides MVM trainees with the basic capacity to earn a living which in turn enhances their sustainability. It is against this background that this study tends to examine the technological skills requisite by motor vehicle mechanics trainees of technical colleges for optimal productivity and sustainability in Ogun State, Nigeria.

**Statement of the Problem**

Despite the regular appraisal of MVM curriculum of technical colleges in fostering economic growth and development, there is a dearth of research specifically addressing the technological skills requisite of trainees for diagnosing faults and servicing electronics control units (ECUs) of modern motor vehicle which are being operated and controlled by computerized electrical sensors. The existing literatures predominantly address basic skills requisite in repairing mechanical faults in conventional vehicles which might not be in vogue and full of doubt as recent development in technology have eroded some operations in which modern motor vehicle operates. In addition, it is evident that most MVM trainees who generally enjoyed the regular flow of customers for effective maintenance and repairs of conventional vehicles are now faced with the challenges of diagnosing and servicing modern vehicles. This knowledge gap is particularly pronounced in Ogun State, where access to quality technology education is limited and demand for skilled automotive technicians continues to increase. Thus, understanding the specific technological skills requisite of motor vehicle mechanics trainees of technical colleges in this context is imperative for improving the productivity. Hence, this study.

**Objectives of the Study**

The main objective of this study is to examine the technological skills requisite by motor vehicle mechanics trainees of technical colleges for optimal productivity and sustainability in Ogun State Nigeria. Specifically, the study sought to examine the technological skills requisite in;

i. diagnosing faults in motor vehicle engine and its support system
ii. servicing electronics control units (ECUs) in motor vehicle

**Research Questions**

The following research questions guided the study

i. What are the technology skills requisite of motor vehicle mechanics trainees in diagnosing faults in motor vehicle engine and its support system?
ii. What are the technology skills requisite of motor vehicle mechanics trainees in servicing electronics control units (ECUs) in motor vehicle?

**Hypotheses**

The following null hypotheses were formulated and tested at 0.05 level of significance.

i. There is no significant difference between the mean rating of MVM teachers and automobile industrial technicians on technological skills requisite in diagnosing faults in motor vehicle engine and its support system.
ii. There is no significant difference between the mean rating of MVM teachers and automobile industrial technicians on technological skills requisite in servicing electronics control units (ECUs) in motor vehicle.

**Methodology**

A descriptive survey research design was employed for this study. Three hundred and fifty-four professional comprising of 28 MVM teachers in nine technical colleges and 326 registered automobile industrial technicians in Ogun State constituted the study population. Total enumeration was used to select all the 28 MVM teachers because of manageable size while proportionate stratified random sampling techniques was used to select 89 registered automobile industrial technicians in Ogun State as study sample. The instrument for data collection was a 17-item structured questionnaire titled 'Technology Skills Requisite Trainees Questionnaire' (TSRTQ) designed based on the existing literatures. The questionnaire was made of two sections A and B. Section A was designed to solicit demographic data from the respondents while section B focused on the research questions. It was based on four point modified Likert scale of Highly Required (HR-4); Required (R-3); Slightly Required (SR-2) and Not Required (NR-4). The questionnaire was face and content validated by three research experts from the Department of Industrial Technical Education, Tai Solarin University of Education, Ijagun. A pilot study of the instrument was carried out on 12 MVM teachers in the five (5) Government Technical Colleges in Oyo State and 44 registered automobile industrial technicians in Oyo metropolis. The result obtained from the pilot study was subjected to reliability of internal consistency test using Cronbach's Alpha coefficient which yielded a coefficient of 0.86. The researcher employed the aid of three research assistants in data collection and 100% return rate was obtained. Mean and standard deviation was used to answer the research questions while t-test was used to test the hypotheses at 0.05 level of significance.

## Results and Discussion

### Research Question 1

What are the technology skills requisite of motor vehicle mechanics trainees in diagnosing faults in motor vehicle engine and its support system?

**Table 1: Respondents mean score on technology skills requisite of motor vehicle mechanics trainees in diagnosing faults in motor vehicle engine and its support system.**

| S/N | Items | Mean | SD | Remark |
|---|---|---|---|---|
| 1 | Read and comprehend charts, technical drawings, and blue prints. | 3.67 | 0.60 | HR |
| 2 | Think critically and approach things with an inquisitive mindset. | 3.25 | 0.58 | R |
| 3 | Handle well, modern diagnostic equipment to perform On-Board-Diagnoses (OBD) | 3.71 | 0.54 | HR |
| 4 | Critically analyse and interpret faults from diagnosis results | 3.76 | 0.59 | HR |
| 5 | Conduct engine performance test using engine analyser | 3.55 | 0.58 | HR |
| 6 | Distinguish abnormal sounds in the engine | 3.72 | 0.57 | HR |
| 7 | Localise such sounds to specific components or systems | 3.18 | 0.57 | R |
| 8 | Confidently determine needed repairs on components and systems being diagnosed | 3.45 | 0.59 | R |
| | Average Mean | 3.53 | 0.57 | HR |

Data presented in Table 1 showed the mean score of the data from the respondents' view about the technology skills requisite of motor vehicle mechanics trainees in diagnosing faults in motor vehicle engine and its support system. Item 4 showed the highest mean score of 3.76 which pointed out for a skill to critically analyse and interpret faults from diagnosis results. All the eight items had a mean score above 2.50 cut off point. An average mean score of 3.23 was obtained meaning that the respondents agreed positively to the stated items. The results also showed the standard deviation ranged from 0.54 to 0.60 indicating that the respondents were not too far from one another in their responses, proving that respondents' opinions or responses were similar.

**Research Question 2**
What are the technology skills requisite of motor vehicle mechanics trainees in servicing electronics control units (ECUs) in motor vehicle?

**Table 2: Respondents mean score on the technology skills requisite of motor vehicle mechanics trainees in servicing electronics control units (ECUs) in motor vehicle**

| S/N | Items | Mean | SD | Remark |
|---|---|---|---|---|
| 1 | Critically analyse and interpret faults from diagnosis results | 3.79 | 0.57 | HR |
| 2 | Knowledge in locating the position of ECU in different vehicles | 3.54 | 0.60 | HR |
| 3 | Knowledge of the working principle of ECU | 3.56 | 0.62 | HR |
| 4 | Basic skills in safe handling and maintenance of ECU | 3.41 | 0.61 | R |
| 5 | Knowledge of the concept of On-Board Diagnostics (OBD) in motor vehicles | 3.43 | 0.58 | R |
| 6 | Skills in the programming and reprogramming of ECU to manufacturers' specification | 3.67 | 0.58 | HR |
| 7 | Skills in determining the failure of semi-conductor components linking the ECU to the vehicle | 3.65 | 0.60 | HR |
| 8 | Skills in recognizing and interpreting signals from the ECU | 3.67 | 0.59 | HR |
| 9 | Knowledge in understanding and interpreting electrical circuits in vehicle | 3.54 | 0.61 | HR |
| | Average Mean | 3.58 | 0.59 | HR |

Based on the data presented in Table 2 it was evident that all the five items were rated above 2.50. Item 1 showed the highest mean score of 3.79 which outlined need for a skill in analysing and interpreting faults from diagnosis results. 3.58 average mean was obtained from the items which proved that all the respondents reacted positively to the statement showing the technology skills requisite of motor vehicle mechanics trainees in servicing electronics control units (ECUs) in motor vehicle. The results also showed the standard deviation ranged from 0.57 to 0.62 indicating that the respondents were not too far from one another in their responses, proving that the respondents' opinions or responses were similar.

## Hypothesis One

There is no significant difference between the mean rating of MVM teachers and automobile industrial technicians on technological skills requisite in diagnosing faults in motor vehicle engine and its support system.

**Table 3: Summary of t-test of differences between the mean rating of MVM teachers and automobile industrial technicians on technological skills requisite in diagnosing faults in motor vehicle engine and its support system**

| Group | N | Mean | SD | T | df | Sig. | Remarks |
|---|---|---|---|---|---|---|---|
| MVM teachers | 28 | 9.02 | 1.73 | 1.02 | 116 | 0.12 | NS |
| Automobile industrial technicians | 89 | 7.37 | 1.65 | | | | |

Data from Table 3 revealed a not significant difference between MVM teachers (M = 9.02; SD = 1.73) and automobile industrial technicians (M = 7.37; SD = 1.65) (t = 1.02; df = 116; p > 0.05). The hypothesis was therefore not rejected in the light of the result. Hence, there is no significant difference in the mean rating of MVM teachers and automobile industrial technicians on technological skills requisite in diagnosing faults in motor vehicle engine and its support system

## Hypothesis Two

There is no significant difference between the mean rating of MVM teachers and automobile industrial technicians on technological skills requisite in servicing electronics control units (ECUs) in motor vehicle

**Table 4: Summary of t-test of differences between the mean rating of MVM teachers and automobile industrial technicians on technological skills requisite in servicing electronics control units (ECUs) in motor vehicle**

| Group | N | Mean | SD | T | df | Sig. | Remarks |
|---|---|---|---|---|---|---|---|
| MVMW teachers | 28 | 13.38 | 3.83 | 2.19 | 116 | 0.24 | NS |
| Automobile industrial technicians | 89 | 13.26 | 3.81 | | | | |

Data from Table 4 revealed a not significant difference between MVM teachers (M = 13.38; SD = 3.83) and automobile industrial

technicians (M = 13.26; SD = 3.81) (t = 2.19; df = 116; p < 0.02). This implies that the hypothesis was upheld. Therefore, there is no significant difference between the mean rating of MVM teachers and automobile industrial technicians on technological skills requisite in servicing electronics control units (ECUs) in motor vehicle.

**Discussion of Findings**

Findings from research question 1 showed that respondents agreed with all the items on the technology skills requisite of motor vehicle mechanics trainees in diagnosing faults in motor vehicle engine and its support system. The findings revealed that it is essential for trainees to be equipped with the skills necessary to operate modern diagnostic equipment for performing On-Board Diagnostics (OBD). Likewise, on hypothesis 1 the respondents did not differ in the items identified. This implies that the identified technological skills are required in diagnosing faults in motor vehicle engine and its support system to ensure optimum productivity among MVM trainees. This is in line with the opinion of Abdulkadir, et al. (2022); Adeniran et al. (2024) and Thomas et al. (2023) who outlined skills required in diagnosing faults in automobile engine to include reading and understanding blue prints, technical drawings, charts, critical thinking, handling modern diagnostic equipment, understanding computer controls, conducting engine testing, inspection, and examination of lubrication system and components.

Findings from research question 2 showed that respondents agreed with all the items on the technology skills requisite of motor vehicle mechanics trainees in servicing electronics control units (ECUs) in motor vehicle. Also, on hypothesis 2 the respondents did not differ in the items identified. This implies that the identified technological skills are required in servicing electronics control units (ECUs) in motor vehicle to ensure optimum productivity among MVM trainees. The skills identified are in consonance with the findings of Abubakar and Abutu (2019) and Thomas et al. (2023) who posited that it is imperative for automotive mechanics to be updated with the required skills in handling ECU of motor vehicles because of the multiple functions performed by the ECU in terms of receiving and transmitting signals and On-Board Diagnostic information between sensors and actuators in modern vehicles.

**Conclusion**

The study concluded that the identified technological skills are basic requisite for optimum productivity in automobile industry. Therefore,

MVM trainees are expected to be equipped with these skills in other to be relevant in the automobile industry. These technological skills will distinguish the MVM trainees out among several automobile mechanics in the industry thereby building confidence and believe in clients that they are competent enough to have their vehicles fixed by them. This productivity will continue to leads to increase in patronage thereby enhancing their sustainability in turn.

## Recommendations

Based on the findings of the study, the following recommendations were made;

i. Curriculum planners and policy makers should ensure that MVM curriculum is review to incorporate technological skills requisite in motor vehicle industry to enable trainees' suite in and enhance their sustainable development upon graduation.
ii. Government, automobile industries and professional vocational associations should organize seminars and workshops for MVW trainees to improve their skills in maintaining modern vehicles.

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