Emerging Workshop Competencies Needed for Establishing Automobile Enterprises by Motor Vehicle Mechanics in Fuel and Ignition Systems Maintenance in Bayelsa State, Nigeria

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Abstract
This study aimed to determine the emerging workshop competencies needed for the establishment of Automobile enterprise by motor vehicle mechanics trade in fuel and ignition maintenance in Yenagoa, Bayelsa State, Nigeria. The research was guided by two purposes, two research questions, and two null hypotheses. A descriptive research design was adopted, with a population of 154 respondents, comprising 140 master craftsmen (motor vehicle mechanics) selected using a random sampling technique and 14 automobile industrial technicians. Data were collected using a structured questionnaire titled Automobile Enterprises Emerging Workshop Competencies Questionnaire (AEEWCQ), adapted and validated by three experts. The reliability coefficient of the instrument was 0.85, established using Cronbach's Alpha. Data analysis was conducted using SPSS Version 23, while mean and standard deviation were used to answered the research questions and z-test statistics used to test hypotheses at a 0.05 significance level. Findings indicated that all identified competencies were considered highly essential for establishing viable automobile workshops in Yenagoa. The study recommends that the National Automotive Design and Development Council (NADDC), working with the Federal Ministry of Labour and Productivity, integrate these competencies into mechanic training programs to build current capacity for modern vehicles. Likewise, since many mechanics were trained through technical colleges, the National Board for Technical Education (NBTE) should embed these competencies into curricula to improve graduates' readiness for entrepreneurship and modern vehicle servicing.

Keywords: Automobile Enterprise, Motor Vehicle Mechanic, Emerging Workshop Competencies, Maintenance,

Introduction

In Nigeria, motor vehicle mechanics play a vital role in keeping our transportation systems running. Motor vehicle mechanics are essential to Nigeria's transport and industrial ecosystem. The Motor Vehicle Mechanic (MVM) trade forms a major branch of mechanical engineering requiring both scientific understanding and hands-on expertise in the design, construction, operation, and maintenance of motor vehicles. At technical college level, training is divided into Service Station Work, Engine Maintenance and Repairs, and Auto Electricity (Hamidu et al., 2022). Welbur (1999) defined a mechanic as a trained individual who diagnoses, services, and repairs malfunctioning vehicle systems, ranging from the engine and drivetrain to suspension and braking systems.Recent literature makes it clear that the work of today's motor vehicle mechanic is no longer limited to spanners and wrenches alone.Modern vehicles now demand a mix of traditional hands-on skills and the ability to diagnose faults using electronic and computerized systems. As Muoghalu & Ahmad (2024) point out, effective repair work increasingly requires technicians to bridge mechanical know-how with auto-electronics and digital troubleshooting tools.

One of the areas where this shift is most visible is in fuel and ignition systems.

Cars are no longer controlled through basic mechanical parts but through complex electronic control units and multiple sensors. According to Opeyemi & Mary (2024), these systems require mechanics to learn how to test, calibrate, and interpret information from fuel and ignition components skills that go beyond what many traditional mechanics were trained to do. Another challenge identified across studies is the lack of essential workshop tools. Without scanners, pressure testers, or timing analyzers, mechanics struggle to accurately diagnose engine faults in today's vehicles. Olawale (2024) stresses that many workshops still lack this modern diagnostic equipment and the technical confidence needed to use it effectively. Poripo (2024; 2025) further described motor vehicle mechanics work as rooted in scientific principles material selection, mechanical design, fabrication, and maintenance equipping learners with industry-relevant knowledge and practical competence (Poripo et al., 2020).

Modern automotive programs in tertiary institutions are designed to develop practitioners capable of testing, diagnosing, servicing, and repairing vehicle systems according to manufacturers' guidelines (NBTE, 2003). Automobile engineering emphasizes not only theoretical knowledge but also problem solving, innovation, and self-reliance skills essential for industrial advancement and entrepreneurship (Poripo, 2024). An automobile enterprise is a business operation focused on vehicle sales, servicing, and repairs. These privately owned workshops commonly established by master craftsmen serve as hubs for self-employment and job creation (Hamidu et al., 2022; Olaitan & Ikeh, 2015). Additional enterprise streams include spare parts distribution, vehicle body work, painting, auto electrical repairs, and panel beating.

Maintenance involves keeping machinery in optimal functional state, restoring faults when necessary (Okah-Avae, 1995; Akinola & Ogedengbe, 2005). Narayan (2004) emphasized preventive care to prolong equipment life. In the automobile context, maintenance now includes servicing sophisticated emission-controlled engines, meaning mechanics must possess new technological skills to handle modern systems (Hamidu et al., 2022). Emerging workshop competencies refer to newly required technical abilities for servicing advanced automotive systems electronic fuel injectors, onboard diagnostics, hybrid drives, electronic transmissions, and autonomous sensing systems (Osinem, 2008). Modern vehicles are heavily embedded with electronic controls, sensors, and diagnostic modules, especially within the fuel, ignition, and transmission systems (Abubakar et al., 2015; Nna, 2001). In addition to technical upgrades, researchers emphasize the need for mechanics to think more like business owners. Running a workshop today also requires competencies in customer service, pricing, record-keeping, and managing spare parts. Muoghalu & Ahmad (2024) argue that entrepreneurial ability now works hand-in-hand with technical expertise in determining whether a workshop succeeds or shuts down.

Fuel systems must supply the correct fuel-air mixture at precise pressure and timing (Bosch, 2011; Giri, 2013). Ignition systems, now largely electronic, deliver timed sparks with minimal emissions (Salami, 2007). Transmission's manual and automatic are increasingly operated via microprocessor-controlled units (Giri, 2013). This technological shift poses challenges. Many mechanics accustomed to conventional mechanical systems struggle to diagnose or repair modern vehicles controlled by sensors and computerized modules (Aruku, 2007; Nyapson, 2015). Consequently, vehicle owners bypass local workshops or leave modern cars unrepaired. With vehicle technology changing rapidly, informal artisans

must keep retraining to stay relevant. As Olawale (2024) explains, lifelong learning and periodic upskilling are becoming essential practices for mechanics, rather than optional extras.

These observations align with national efforts to modernize technical education in Nigeria. Training programs across the country now prioritize mechatronics, fuel injection systems, and computer-assisted diagnostics. Opeyemi & Mary (2024) note that recent government skills initiatives are directly targeted at preparing technicians to work confidently with electronically controlled vehicles. Moreso, there is strong evidence that mechanics who embrace these emerging competencies have a better chance of running successful workshops and automobile enterprise. Olawale (2024) reports that technicians who adopt new tools and technologies tend to attract more customers and keep their businesses afloat longer than those relying on outdated methods. This study therefore set out to identify the specific emerging workshop competencies needed by motor vehicle mechanics in Yenagoa, Bayelsa State to competently maintain fuel and ignition systems in contemporary vehicles.

Purpose of the Study

The general purpose of this study is to identify the emerging workshop competencies needed for establishing automobile enterprise by Motor Vehicle Mechanics in fuel and ignition systems maintenance in Yenagoa, Bayelsa State, Nigeria; Specifically, the study sought to determine:

1. the emerging workshop competencies needed by motor vehicle mechanics in the maintenance of fuel System for the establishment of automobile enterprise.
2. the emerging workshop competencies needed by motor vehicle mechanics in the maintenance of Ignition System for the establishment of automobile enterprise.

Research Questions

The following research questions were answered in this study;

1. What are the emerging workshop competencies needed by motor vehicle mechanics in the maintenance of fuel system for the establishment of automobile enterprise?
2. What are the emerging workshop competencies needed by motor vehicle mechanics in the maintenance of ignition system for the establishment of automobile enterprise?

Hypotheses

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

1. There is no significant difference in the mean responses of motor vehicle mechanic master craftsmen and automobile industrial technicians as regards the emerging workshop competencies needed by motor vehicle mechanics in the maintenance of fuel system for the establishment of automobile enterprise.
2. There is no significant difference in the mean responses of motor vehicle mechanic master craftsmen and automobile industrial technicians as regards the emerging workshop competencies needed by motor vehicle mechanics in the maintenance of ignition system for the establishment of automobile enterprise.

Methodology

The study used a descriptive survey research design and was conducted in Yenagoa, Bayelsa State. Two purposes of the study, two research questions and two null hypotheses guided the study. The population for the study is 154. This comprised of 140 motor vehicle mechanic master craftsmen and 14 automobile industrial technicians selected

through a random sampling technique. Data were gathered using the Automobile Enterprises Emerging Workshop Competencies Questionnaire (AEEWTCQ) as instrument for data collection. The instrument was validated by three experts. Responses were rated on a four-point rating scale ranging from: Highly Needed (4), Needed (3), Moderately Needed (2), and Not Needed (1). Reliability testing produced a coefficient of 0.85 using Cronbach's Alpha. All 154 questionnaires were returned and analysed using SPSS (Version 23). Mean and standard deviation were used to answer the research questions, while z-tests statistic was used to test the null hypotheses at a 0.05 significance level. Decisions were based on p-values, with hypotheses rejected when $p < 0.05$ and accepted when $p \geq 0.05$.

Results

Research Question 1

What are the emerging workshop competencies needed by motor vehicle mechanics in the maintenance of fuel system for the establishment of automobile enterprise?

Table 1

Mean and Standard Deviation on the Emerging Workshop Competencies Needed by Motor Vehicle Mechanics in the Maintenance of Fuel System for the Establishment of Automobile Enterprise.

S/No	Items	N	Mean	SD	Decision
1	Ability to remove fuel injection fuel rail.	154	3.51	0.33	Highly Needed
2	Ability to remove pressure regulator.	154	3.53	0.25	Highly Needed
3	Removing and replacing electronics faulty injectors.	154	3.56	0.25	Highly Needed
4	Replacing new O-ring onto new injector.	154	3.51	0.35	Highly Needed
5	Undertaking visual inspection of the air mass sensor.	154	3.65	0.35	Highly Needed
6	Checking for leakages in induction and exhaust system.	154	3.53	0.25	Highly Needed
7	Using multi-meter to check for oxygen sensor.	154	3.65	0.35	Highly Needed
8	Checking the oxygen sensor for possible damage.	154	3.59	0.30	Highly Needed
9	Ability to check malfunction indicator or lamp.	154	3.57	0.19	Highly Needed
10	Competency in checking fuel injector using multi-meter.	154	3.63	0.94	Highly Needed
11	Competency in checking fuel pump and its circuits.	154	3.61	0.12	Highly Needed
12	Checking pressure sensor and power control module.	154	3.51	0.12	Highly Needed

13	Using scan tool to check for fuel pressure by controlling the of the pump.	154	3.68	0.01	Highly Needed
14	Competency in undertaking throttle actuator inspection.	154	3.56	0.20	Highly Needed
15	Ability to use fuel calibration machine to determine fuel consumption by the engine.	154	3.64	0.13	Highly Needed
16	Testing gasoline engines for functional sensors.	154	3.59	0.30	Highly Needed
17	Checking and adjusting the idling speed.	152	3.52	0.25	Highly Needed
18	Using multi-meter to test run fuel system so as to clear the trouble codes.	154	3.64	0.23	Highly Needed
19	Using vehicle communication kit to check fuel injection malfunction.	154	3.61	0.27	Highly Needed
20	Interpretation of the printed fuel system diagnostics codes.	154	3.53	0.28	Highly Needed
21	Undertaking the maintenance of fuel system circuit.	154	3.54	0.23	Highly Needed
22	Competency in proper injector cleaning.	154	3.51	0.28	Highly Needed
23	Competency in inspecting all under hood wiring.	154	3.58	0.32	Highly Needed
	Grand Mean/SD		**3.52**	**0.34**	**Highly Needed**

Note: N = Number of Respondents, SD = Standard Deviation

The results in Table 1 showed that the respondents agreed with all the 23 items such as ability to remove fuel injection fuel rail, ability to remove pressure regulator and removing and replacing electronics faulty injectors amongst others were highly needed with grand mean of 3.52 as emerging workshop competencies needed by motor vehicle mechanics in the maintenance of fuel system for the establishment of automobile enterprises.

Research Question 2

What are the emerging workshop competencies needed by motor vehicle mechanics in the maintenance of ignition system for the establishment of automobile enterprise?

Table 2

Mean and Standard Deviation on Emerging Workshop Competencies Needed by Motor Vehicle Mechanics in the Maintenance of Ignition System for the Establishment of Automobile Enterprise

S/No	Items	N	Mean	SD	Decision

1	Ability to use digital multi-meter to record Ignition timing.	154	3.51	0.27	Highly Needed
2	Performing magnetic sensor testing.	154	3.56	0.04	Highly Needed
3	Use of multi-meter to test the ignition system.	154	3.50	0.28	Highly Needed
4	Use of adapter or plug wire to check spark.	154	3.60	0.30	Highly Needed
5	Using diagnostic tool to check for crank sensor.	154	3.65	0.35	Highly Needed
6	Identification of ignition problem.	154	3.55	0.21	Highly Needed
7	Ability to print recorded ignition diagnostics trouble codes	154	3.57	0.19	Highly Needed
8	Ability to retrieve ignition diagnostics trouble codes.	154	3.60	0.28	Highly Needed
9	Interpretation of ignition diagnostics trouble codes.	154	3.69	0.30	Highly Needed
10	Testing and diagnosing faulty reluctor sensor	154	3.51	0.01	Highly Needed
11	Using multi-meter and oscilloscope to for voltage and signal supply.	154	3.66	0.20	Highly Needed
12	Inspect and adjusting faulty crank position sensor.	154	3.55	0.35	Highly Needed
13	Checking both crankshaft and camshaft sensors and their wiring for possible damage.	154	3.69	0.30	Highly Needed
14	Ability to inspect, repair and replace faulty electronic ignition components.	154	3.55	0.21	Highly Needed
15	Checking the battery for enough voltage needed to crank the engine.	154	3.51	0.01	Highly Needed
16	Electronic Ignition system	154	3.55	0.35	Highly Needed
17	Distributor less ignition	154	3.65	0.35	Highly Needed
18	Electronic Force Distribution	154	3.61	0.12	Highly Needed
	Grand Mean/SD		**3.55**	**0.24**	**Highly Needed**

Note: N = Number of Respondents, SD = Standard Deviation

Results in Table 2 revealed that the respondents agreed with all the 18 items such as ability to use digital multi-meter to record ignition timing, performing magnetic sensor testing and use of multi-meter to test the ignition system amongst others were highly needed with grand mean of 3.55 as emerging workshop competencies needed by motor vehicle mechanics in the maintenance of ignition system for the establishment of automobile enterprises.

Hypothesis Testing

Table 3

Z – test of difference between the mean scores of motor vehicle mechanic master craftsmen and automobile industrial technicians on the emerging workshop competencies needed by motor vehicle mechanics in the maintenance of fuel system for the establishment of automobile enterprise.

Motor vehicle mechanics	N	Mean	S.D	Df	Z	P-value
Motor vehicle mechanic master craftsmen	140	3.24	0.76	153	-.467	.641

Automobile industrial technicians	14	3.29	0.61

Table 3 revealed that there is no significant difference (P<.05) in the mean score of the respondents. Z (153) = -.467, p = 0.641. Therefore, the null hypothesis was accepted indicating that there was no significant difference between the mean response of motor vehicle mechanic and automobile industrial technicians on maintenance of fuel systems for establishing automobile enterprises in Yenagoa, Bayelsa State.

Table 4

Z – test of difference between the mean scores of motor vehicle mechanic master craftsmen and automobile industrial technicians on the emerging workshop competencies needed by motor vehicle mechanics in the maintenance of ignition system for the establishment of automobile enterprise.

Motor vehicle mechanics	N	Mean	S.D	Df	Z	P-value
Motor vehicle mechanic master craftsmen	140	3.26	0.79			
				153	-.458	0.647
Automobile industrial technicians	14	3.32	0.65			

Table 4 revealed that there is no significant difference (P<.05) in the mean score of the respondents. Z (153) = -.458, p = 0.647. Therefore, the null hypothesis was accepted indicating that there was no significant difference between the mean response of motor vehicle mechanic and automobile industrial technicians on maintenance of ignition systems for establishing automobile enterprises in Yenagoa, Bayelsa State.

Discussion of Findings

Findings revealed that mechanics require strong diagnostic capacity, especially in using multi-meters, scanners, and electronic tools to evaluate fuel injectors and ignition components skills highlighted by Hamidu et al. (2022), Schutte et al. (2004), and Allen & Derek (2012). With electronic management systems standard on modern vehicles, the ability to interpret digital signals, retrieve diagnostic codes, and trace faults has become indispensable (Hella Tech World, 2019).

The findings in Table 1 revealed that motor vehicle mechanics needs the ability to check fuel injectors using multi-meter. This in conformity with the opinion of Hamidu, et al, (2022) & Schutte et al, (2004) who stated that the principal idea in the use of multi-meter was to detect the voltage signals of the injectors in order to determine flow of the fuel. This finding was further corroborated by Allen & Derek, (2012) who asserted that the electrical part of a petrol injector consists of a wire coil that has a known resistance. If there is a problem with the injector it may be due to a poor connection or a partial short-circuit; in either way, a multi-meter/ohmmeter will be used to test the condition of the electrical part of the injector.

The findings in Table 2 revealed that motor vehicle mechanics needs the ability to use digital multimeter to test ignition system. This is in agreement with the work of Hamidu, et al, (2022) & Hella Tech World (2019) who maintained that although diagnosable engine management system is installed in today's vehicles, a multi-meter or oscilloscope must

be used when checking ignition systems. To trace faults, technician needs to be equipped with the right skills on the use of instruments like multi-meters and oscilloscopes.

Conclusion

The study established that all emerging competencies related to fuel, ignition and broadly electronic vehicle technology are critically important for mechanics in Yenagoa wishing to operate viable automobile enterprises. If adequately trained in these skills, mechanics would be better equipped to diagnose, maintain, and repair modern vehicles independently. The findings of the study serve as the basis for making the following conclusion: That all the emerging technology competencies on fuel system, ignition system and transmission system are highly needed by motor vehicle mechanics for the establishment of automobile enterprises. Accordingly, if the findings of this study are effectively utilized a batch of highly skilled motor vehicle mechanic craftsmen in the area of undertaking the maintenance and repairs of modern automotive will be produced.

Recommendations

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

1. The NADDC should collaborate with the Federal Ministry of Labour to include these competencies in formal and refresher training for practicing mechanics.
2. Training should emphasize modern automotive electronics, enabling mechanics to confidently repair contemporary vehicles within their workshops.
3. NBTE should revise technical curricula to embed these competencies and improve graduate readiness for self-employment in the automotive sector

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