



CORE ON-BOARD DIAGNOSTIC SKILLS REQUIRED BY MOTOR VEHICLE MECHANICS FOR TROUBLESHOOTING ENGINE PERFORMANCE AND TRANSMISSION SYSTEM OF MODERN AUTOMOTIVE IN NIGER STATE

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Abstract

The era of depending solely on trial by error method and the experience of motor vehicle mechanics when troubleshooting various systems and subsystems of modern automotive is gradually coming to an end. This study was therefore carried out to identify the core on-board diagnostic (OBD) skills required by motor vehicle mechanics for troubleshooting engine performance and transmission system of modern automotive in Niger State. A survey research design was employed for the study. The population for the study comprised 833 motor vehicle mechanic master craftsmen and 29 automobile technology lecturers. A structured questionnaire which was designed by the researcher was used for collecting data from the respondents. The instrument was validated by three experts. Cronbach alpha reliability method was employed to determine the internal consistency of the questionnaire items and reliability coefficient of 0.84 was obtained. Two research questions guided the study while the two null hypotheses formulated were tested at 0.05 level of significance. Mean and standard deviation were used to answer the research questions while z-test statistics was used to test the null hypotheses at 0.05 levels of significance. It was found out that all the forty skills suggested are required by motor vehicle mechanics for troubleshooting engine performance and transmission system of modern for modern automotive. It was therefore recommended that all the skills identified in this study be included in the training given to motor vehicle mechanics apprentices in Niger State. \The state government should come to the aid of the motor vehicle mechanics by providing funds to enable them undertake the training as well as procure OBD scan tool.

Keywords: *Diagnostic, Skills, Required, Performance, Transmission.*

Introduction

Motor vehicle mechanics are the experts saddled with the responsibility of inspecting, troubleshooting, repairing and maintaining of cars, buses, trucks, motorcycles and other vehicles in order to make such automotive roadworthy. According to Hiller & Coombes (2014) and Penn (2011), Motor Vehicle Mechanics are skilled personnel, trained in auto mechanics, specialized in motor vehicle troubleshooting, maintenance, repairs and sometimes modification of motor vehicles which also encompasses auto body repair and spraying or painting, auto electrical work, auto body mechanic work, auto body building (panel beating) and auto parts merchandise. In the opinion of Baba, Jacob and Issifu (2018) and Motavalli, (2010), since modern automotive running on the roads are now being manufactured and controlled by modern technology, proper troubleshooting and maintenance of faults associated with these vehicles can only be best carried out by a skilful motor vehicle mechanics who will be competent enough to fully undertake the troubleshooting of various aspects of modern vehicles.

Troubleshooting generally refer to a form of problem solving technique or skill most often applied to repair failed components or systems. It is a systematic and logical search for the root cause of a problem so that it can be rectified such that the components and systems can be restored back to it functional state. Good troubleshooting of modern automotive in the word of Kevin (2014), involves the ability of mechanics to adopt diagnostic skills in retrieving Diagnostic Trouble Codes (DTCs) as well as the use of a scan tool that communicates with the vehicle's on-board computer to access the OBD-II system in order to review history and affirm if it is a pending, current, or permanent fault, diagnose according to the steps in the repair manual. This means that for mechanics to do these, he/she must possess the required skills in the use of OBD scan tool.

Skill is a unique ability which an individual has (an inborn trait, or learnt through apprenticeship) which he/she uses to perform a task. Skills according to Idris, Saba and Mustapha (2014) and Adetokunbo (2009) denotes an ability possessed by an individual which enables him to perform a given task to a high degree of precision and accuracy, which is developed in the course of training and experience demonstrated. Sound skill is always demonstrated by an individual's ability to expertly use manual dexterity in a particular vocation. Udogu (2015) stated that troubleshooting skills required for maintaining and servicing modern automotive includes, performing magnetic sensor testing to identify defective sensor and component, to checking for spark using plug wire or adapter, checking the crank sensor using diagnostic tool among others. However, it is disheartening to know that most motor vehicle mechanics

master craftsmen who teach the apprentice lack the required skills to work not only with special tools and diagnostic equipment, but also with sophisticated electronics and on-board diagnostic scan tool which is the major interface for troubleshooting modern motor vehicle.

On-board diagnostics (OBD) is an automotive term referring to a vehicle's self-diagnostic instructions programmed into the vehicle's on-board computer(s) installed in the vehicle. The on-board computer is also referred to as Engine Control Unit (ECU). The programmes are specifically designed to detect failures in the sensors, actuators, switches and wiring of the various vehicle emissions-related systems. OBD systems turns up and malfunction indication light (MIL) if the computer detects a failure in any of these components or systems (Nandhini, & Vidhya, 2014; Smith, 2006). Early versions of OBD would simply illuminate a malfunction indicator light if a problem was detected but would not provide any information as to the nature of the problem. Modern OBD implementation use a standardized digital communication port to provide real-time data in addition to a standardized series of diagnostic trouble codes (DTCs), which allow one to rapidly identify and remedy malfunctions within the vehicle. However, aspects of modern automotive systems and subsystems that requires adoption of OBD skills for troubleshooting include; engine, braking system, cooling system, transmission system and steering system. Even though modern vehicles are equipped with complex systems that will make them safer and easier to operate, engine remains the heart of automobile.

The automobile engine converts chemical energy in various forms of fuel to thermal energy through combustion. The thermal energy is then converted to mechanical energy which propels the vehicle. The conventional engine consists primarily of the crankshaft, connecting rod, piston and rings, valves, cam shaft(s) among others. Modern day vehicles have very complex systems that are built to make them safer and easier to operate, as well as providing more enjoyable driving experience. In the opinion of Erjavec (2010), the incorporation of sensors and actuators is geared towards enabling vehicle manufacturers produce enough vehicles that are eco-friendlier vehicles and will not have much tailpipe emission that can disrupt the ecological system. These new technologies ranges from optimum power and fuel economy by the engine which is the power unit without exceeding federal regulations, such as emissions levels and Corporate Average Fuel Economy (CAFE) set by the Environmental Protection Agency (EPA). Mechanisms which make this possible include the variable valve timing intelligence (VVTi), knock sensor, Mass Airflow (MAF) sensor, variable camshaft timing among others. However, it should be noted that the power unit becomes ineffective without a functional transmission system.

Transmission system is a key element in the power train that provides a link between the power unit and the vehicle wheels. Mayur (2012) stated that effectiveness in the

torque provided by the power is only achieved if gears of various sizes are able to give the engine a mechanical advantage over the driving wheels while keeping the engine within that range. Inclusion of torque converter, dual clutch transmission (DCT), electrically variable transmission (EVT) alongside sensors like output shaft speed (OSS) sensor, turbine shaft speed sensor (TSS) and other technologies into the transmission system of modern motor vehicles enables the system perform its function effectively. With these innovations, troubleshooting and maintenance of modern automotive is best carried out using the on board diagnostic (OBD) scan tool since most of these systems now are primarily electrically operated. This new approach is not just an upgrade of the primitive trials by error or solely manual technique, it is the one of the major ways a motor vehicle mechanic can remain relevant in 21st century automobile world.

It is a common knowledge that a large proportion of motor vehicle mechanics both experienced and trainees operating in their workshops find it extremely difficult to troubleshoot, repair and maintain modern automotive simply because of lack of on-board diagnostic skills to do so. This study is therefore designed to identify on-board diagnostic skills required by motor vehicle mechanics for troubleshooting modern automotive in Niger State.

Motor vehicle mechanics by default are supposed to be the safe haven where vehicle owners should run to whenever their motor vehicles malfunction. Baba *et al* (2018) stated that motor vehicle mechanics are instrumental in socio-economic development of any society because they render troubleshooting and maintenance services to car owners in order to make their cars roadworthy at all times. Hence, they are supposed to understand the working principles of every system and subsystems of both conventional and modern automotive and be able to relate with each component, troubleshoot the component following established diagnostic procedures and run effective maintenance to restore the faulty components to its full functional state with ease. It is also expected that this skill base should as a matter of necessity not be limited to the primitive manual or mechanical diagnostic procedures, bearing in mind that troubleshooting is now a combination of mechanical and electrical diagnostic procedure, motor vehicle mechanics are supposed to be abreast with on-board diagnostic knowledge which will help them carry out effective maintenance on modern automotive with ease.

However, it has been observed that a key problem area within the current skills base that is often raised by vehicle maintenance companies is the absence of effective practical skills by its labour force in vehicle diagnostics which seems to have become major concern in the automotive industry. The leading skill missing being sound on-board diagnostic skills which involves electronic troubleshooting or fault finding techniques, along with the appropriate actions to be taken in order to rectify identified