

**DIAGNOSTIC APPROACH IN SOLVING AUTOMOTIVE ENGINES PROBLEMS
PEUGEOT AS A CASE STUDY**

BY

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A RESEARCH PROJECT SUBMITTED TO THE

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CERTIFICATION

I Faruku Muhammadu Tilli Matric No 2009/3/33510BT,an undergraduate student of the department of industrial and Technology Education certify that the work embodied in this project is original and has not been submitted in part or full for any other diploma or degree of this or any other University.

Name

Signature

APPROVAL PAGE

This project has been read and approved as meeting the requirement for the award of B.Tech degree in Industrial and Technology Education of the department of industrial and Technology Education. School of Science and Science Education Federal University of Technology, Minna

Supervisor

Sign-Date

HOD

Sign-Date

External Examiner

Sign-Date

DEDICATION

I dedicate this project work to almighty God for his divine favour, love guidance and blessings upon my life

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I wish to appreciate God almighty for his divine favour and guidance given to me for the successful completion of studies in the university. I profoundly acknowledge my project supervisor, Mallam A. M. Idris for spending time to go through the project work for errors. I also have to extend my gratitude to mallam Garba Usman Industrial and Technology Education who has contributed greatly to the success of my academic programme. Gratitude also to the project co-ordinator, Mr Saba.T.M, H.O.D Dr. E.J Ohize and all my lecturers in the department of industrial and technology education who in one or the other contributed greatly to me, may God bless them all and replenish their strength and wisdom. Same gratitude also goes to my beloved friend Hassaini Adamu Magayaki for all what he has done to me may God almighty reward him for the debt I owe him. I also wish to acknowledge the support of my inlaws Abubakar Yahaiya Bawa, Mustapha Yahaiya and their families for their moral and material support may God almighty Allah replenish their strength and wisdom. This project is of no value if I did not acknowledge my parent, brothers and sisters, my beloved wife and daughter for supporting me morally and materials for the success of this project.

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ABSTRACT

This study was designed to assess the diagnostic approach in solving automotive engine problems Peugeot as a case study in Minna and Kaduna metropolis. Three research questions and two null hypotheses were formulated to guide the conduct of the study. A survey research design was adopted for the study. Total number of 400 respondents consisting of 220 Peugeot staff and 180 Peugeot users randomly selected was used as a population for the study. A 38-item questionnaire developed by researcher and validated by three experts of industrial and technology education was used for data collected for the study. Mean and standard deviation were the statistical tools used to analyze the data collected for the study; while t-test statistic was used to test null hypothesis at 0.05 level of significance. The findings among other things reveal that the automobile technicians: Lack modern diagnostic repair equipment; lack skills in the use of scan tools in maintenance work, they lack skill in the use of modern trouble shooting device. Based on the findings it was recommended that Federal Government should set up a technical programme that will see to the improvement of automobile technicians, technicians should be encouraged to buy the diagnostic equipment to facilitate their job National automotive council (NAC) should organize periodic training courses for auto technician. It is concluded that technician should be encouraged to improve their skill by using OBD II computer trouble shooting devices.

CHAPTER ONE

INTRODUCTION

Background of the Study

Automobile is a complex integrated product with more than three thousand (3,000) parts that are put together to work in harmony. Williams and Donald (2007) defined automobile as a vehicle which is used in transporting goods and people from one geographical point to another. Automobile has been in existence as early as 1769, with the creation of steam powered automobile capable of transporting human. But with an increase in technology cars powered by internal combustion engine running on fuel gas was invented in 1806 (Wikipedia, 2009). Automobile industry is an industry that designs, develops, manufactures, markets and repairs the world motor vehicle (Wikipedia, 2007) the efficiency of a vehicle is not determined by the structures or body of the vehicle but is determined by the nature of the engine in the vehicle. Engine is what determines the efficiency of a vehicle, the engine also distinguishes the automobile products from one and other, the engine in a vehicle determines the manufacture. Peugeot engines are different from Mazda engines, most time the structures of vehicle may look alike but the engine are never the same.

According to Kirpal (2006) who defined automobile engine as the combination of parts that change the chemical energy in the fuel to mechanical energy. Salami (2004) defined an engine as a mechanical arrangement for converting chemical energy (burning of the fuel) to mechanical energy (movement of the vehicle). It can be a source of power that makes the wheels go round the car to move. Base on the working principle and mode of manufacture automobile engine can be classified into two major classes:-

1. The internal combustion engine:- it is a class of engine in which burning takes place in the engine combustion chamber, this type of engine is of two categories: petrol ignition and diesel ignition engine.
2. The steam or external combustion engine:- it is a class of engine in which the burning of fuel takes place outside the engine the burning of fuel in the engine cylinder produces high pressure in the engine combustion chamber. The engine comprises the piston, combustion chamber, valve gear, piston rod, valve chest/steam chest and many more components that could not be mentioned. If any of these components that make up an engine is faulty, then, the performance of the engine will be altered and they will not be able to produce to its maximum efficiency in order, for the engine to produce it maximum efficiency it should be properly maintained.

Diagnosing engine fault is an important factor that need to be considered in order to reduce the lost of repairing and restoring an engine, (William, 2007). Modernized automobile vehicle (Peugeot) make use of more advance electronics, computers and wireless communication to assist drivers and enhance safety (Salami, 2007). Most of the modern products of Peugeot (307, 407...) cars are electronic control unit (E.C.U) enabled. E.C.U enabled cars refers to cars that have E.C.U incorporated as a major part of the electrical system. The E.C.U is a computerized micro system that is programmed to centrally control all sensors and system in a modern Peugeot vehicle (Hillier, Combers and Rogers, 2006). The E.C.U also makes it easier to diagnose any fault in the vehicle. Fault diagnostic is usually industrial practice that need to be applied according to guide line. Wikipedia (2007) defined diagnostic as a process of identifying the nature of a problem of something by examining the symptoms.

Engine fault diagnostic is a process that concerned with the identification of engine fault by examining the symptoms giving by the engine (Mani, 2001) Lack of repair equipment and lack of engine fault diagnostic equipment is one of the problem facing the informal automobile sector. No regular or wide spread retraining technical program except for the fairly expensive one organized by Peugeot assembly for the informal sector directly and the non provision for the informal sub sectors in Nigeria Automotive policy (Uwameiye and Iyamu, 2007). Faced with these problems it is apparent that the present sector find it increasingly difficult to diagnose automobile engine fault and also find it difficult to maintain the modern automobile. The more sophisticated automobile becomes the more difficult it is to service. This situation is obvious in Nigeria where there is a low number of formal sector with tedious task of servicing modern automobile (Ogwo, 2004). Most road side mechanics find it so difficult to diagnose Peugeot engine fault, so most time the Peugeot owner take the car back to the company (Peugeot Company) for thorough diagnostic check. Some of these fault are even minor that can be diagnosed by the car owners, but because they have no idea of what they are using servicing and repairing the of car engine is, it cost them more than it should be.

Automotive diagnostic requires information source and a fair return. Diagnostic competency enables the complete and safe repair of automotive engine at the lowest expense to consumer, while most consumers erroneously believe that diagnostic simply require a cheap code reading tools to their neighborhood part stores, the reality is that the full diagnosis and complete repairs of modern electronically complex vehicles (Peugeot) requires more accurate electrical diagnosis is one of the most difficult challenges faced when working on Peugeot modern vehicles considering the large number of system that use electricity in other to operate, been able to quickly diagnose electrical problems can be a real asset if you are attempting to

diagnose an engine control issues, an automatic ride height system vehicle or power window issue the electrical system all utilize the same principle (Guptal, 2007). Diagnosing an electrical part of an engine problem is more mental work that is turning wrench. Ninety percent of solving an engine problem could be done without opening the tools box, the last ten percent of solving the problem might be in testing and repair the faulty part of the engine (Automobile vehicle engine), (Wikipedia, 2009)

Although Peugeot vehicle (products) may be difficult to diagnose, many of the challenges can be eliminated by carefully following a well land down approach. The key to any diagnostic approach is to follow the step in order. Skipping over step or performing the steps in a different sequence can result in a technician missing an important piece of information and this can result in extended repair time and tremendous frustration (Ogwo and Oranu, 2006). Okoro (1993) stated that the major problem automobile technicians are encountering in diagnosing an automotive engine fault is their lack of adequate skills and accurate steps to be taken when diagnosing an automotive engine fault and this has reduce the tendency of automobile technicians to properly diagnose, repair and maintain modern cars (Peugeot products). Thus it is very paramount for automobile technician to know the diagnostic approach in solving automotive engine problem, this has necessitated the researcher to embark on this study.

Statement of the Problem

The continous use of electronic equipment and devices in automobile has changed the work skills and competence required of automobile technicians and these has made some of them to be unable to diagnose an automotive engine fault (kirpal, 2006). There are several cases in which the automobile technician were unable to give an accurate approach to diagnose an engine fault, on the process of trying to repair the engine fault ignorantly remove an electronic

component and wrongly position them, which further added to the vehicle problem and greatly reduce the trust of the car owner on some automobile technicians thereby prefer taken the vehicle to any nearby company of that product.

Purpose of the Study

The purpose of the study is to identify the diagnostic approach in solving automotive engine problem in Peugeot vehicles. Specifically, the study sought to:-

1. Identify the major problems faced by automobile technicians in diagnosing automotive engine problem.
2. Determine how the problems faced by the automobile technician in solving automotive engine problem can be eliminated.
3. Determine the diagnostic approach to be adopted by automobile technician in solving automotive engine problem or fault.

Significance of the Study:

When this project is successfully completed, the following group of people is going to be benefit. Road side mechanic, automobile technicians and car owners. The result of this study will help to improve the performance skills of automobile technicians, motor vehicle owner will also benefit from the result of the study because the expenses on their cars will be lesser as the car engine will be accurately diagnosed if the engine of the car is faulty.

Road side auto mechanics will have opportunities to acquire skills, knowledge, appreciation and interest to repair modern vehicle that are faulty the study will yield results that will solve problems in diagnosing fault in modern vehicle by auto technicians and even the road side mechanics and thus improve their speed and effectiveness of maintenance of modern vehicles.

Vehicle owner will be exposed to basic problems in motor vehicle engine and this will make them to be an informed consumers. The study will help in eradicating fear in vehicle owner toward the road side mechanics for repairing and thus regain confident in the job of road side mechanics,

The result of this study will also help the auto technician to know the sequential steps to be taken in diagnosing an automotive engine fault if the result of this study is properly implemented.

Scope of the Study:

The study is delimited to the major problems faced by automobile technicians in diagnosing automotive engine problems, problems faced by the automobile technicians in solving engine problem can be eliminated and the diagnostic approach to be adopted by automobile technicians in solving automotive engine problems or fault.

Research Questions

The following research questions were formulated to guide the study:-

1. What are the problems faced by automobile technicians in diagnosing automotive engine fault?
2. How can the problems faced by automobile technician in diagnosing automotive engine fault be eliminated?
3. What are the diagnostic approach to be adopted by automobile technician in solving automotive engine problems?

Hypotheses

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

1. There is no significant differences between the mean responses of Peugeot staff and Peugeot users on the problem faced by automobile technicians in diagnosing automotive engine faults.
2. There is no significant differences between the mean responses of Peugeot staff and Peugeot users on ways of solving problems faced by automotive technicians in diagnosing automotive engine faults.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The literature related to this study is reviewed under the following sub-headings.

- History of the automobile
- Automobile technology and automobile innovation
- Concept of automobile diagnosis
- Approach for automobile diagnosis
- New approach for automobile diagnosis & repairs
- Summary of related literature.

History of automobile

The automobile has been for more than 100 years. According to Wikipedia (2009), the history of the automobile begins as early as 1769, with the creation of steam powered automobile capable of human transport. In 1806 the first cars powered by internal combustion engines running on fuel gas appeared, which led to the introduction in 1885 of the ubiquitous gasoline or petrol fuel internal combustion engine and later diesel fueled engine 1892. The automobile, motor car or can be described as a wheeled motor vehicle which carried its own engine and is used for transporting or moving people and goods on the land. Cars powered by electricity brief appeared at the turn of the 20th century but quinit disappeared from commonality until the turn of the 21st century, when interest in low and zero emission transportation was reignited. the first automobile was basically horse-drawn buggies and carriages power by gasoline and diesel fueled engine instead of horses. They were called gas buggies and horseless carriages.

The early engines had one cylinder that could produce only one or two horse power. A horse power is roughly the power of one horse. In 1885 and 1886, Karl Benz built the model automobile in Germany. It had three wheels, one in the front and two in the rear. In 1886, a German, Gottlieb Daimler built a four wheel gas guggy (Wikipedia, 2009). Two brothers, Charles and Frank Duryea built the first automobile in USA in 1893 by 1895 Herrg Ford, ransom olds and other were building cars. William and Donald (2007) reveal that by 1900. Several factories in Detroit and elesru here were building cars that were getting bigger and more expensive. Fold wanted to make cars as cheap as possible so that more people could buy them. By 1908, he had the car in production that put America on wheels. This was the model-T fold manufactured on the first modern assemble line and this marked the beginning of mass production in auto industry.

Presently the automobile is a commonly used product but it is an extremely complex and technologically sophisticated one. Today's automobile is a complex integrated product with more than 3000 parts that all need to work in harmony (Wikipedia, 2007). Automobile plays a major role in people live whether it is used for doing transportation or used for pleasure. In this regards the development of the vehicle industry is instrumental to personal life today the automobile industry is one of the biggest in the world.

Automobile technology and automobile innovation

Innovation is a new way of doing some things. Amitabh (2009) defined innovation as the exploitation of new ideas leading to the creation of a new product, process or services. He further stated that it is not just the invention of a new idea that is important, but it is actually bringing it to market, putting it into practice and exploiting it in a manner that lead to new products, services

or systems that add value or improve quality it possibly involves technological transformation and management restructuring. Innovation also means exploiting new technology and employing out of the box thinking to generate new value and to bring about significant changes in society.

Schumpeter (1999) distinguish between invention and innovation as an idea made manifest and innovation as an idea applied successfully in practice the further reveals that there are different types of innovation such as product innovation that entails the implementation of a new product or services that is new or considerably improved, process innovation comprising the implementation of a new or a significantly enhanced product or delivery method, "supply chain innovation which innovation transforms the sourcing of inputs products from the market and the delivery of output products to customers and " marketing innovation" which result in the evolution of new method of marketing with enhancement in product design or packaging, its promotion or pricing, among others.

Eric (2008) identifies two sources of innovations manufacturer innovation" where person or company in order to sell the innovation and user innovation" where a person or company develops an innovation for their own use because existing product do not meet their needs. He further stressed that competition is the determinant of innovation. Productivity and wealth creation. Innovation there force involves the introduction of new product, new service, new processes, new business system and new method of management which have a significant positive impact on productivity and growth of an organization.

Kipal (2008) reveal that the world largest automobile manufacturer " general motor (GM)" has gone deep into innovation to broaden its original acquiring other smaller Oem companies and increasing its technical alliance with Honda and Toyota auto manufacturer. The

GM's heritage in innovation includes first speedometer. First electric self starter, first fully automatic transmission, collapsible steering column, catalytic converter, first crash test dummies, first child restraint system, first computerized crash test, first integrated chassis control system and advance virtual reality technology. Competitive pressure have forced most automobile companies to increase their focus on innovation. The auto industry has significantly expanded the electronic and computer content on the vehicles with applications ranging from power train controls for improved fuel economy and reduced emission, to enhanced safety system and chassis control to on board communication system like Onstar.

(Eric, 2008). The precision and super fast speed of computers have made major advancement possible in auto engineering. Today, electronic comprises more than twenty five percent (25%) of each automobile and that figure is expected to grow to more than thirty percent (30%) by 2012 (Wikipedia, 2009) automobile computers and electronics takes care of everything from airbag safety and antilock braking system to fuel efficiency, clean auto technology and global positioning system (GPS) with the present trend in innovation in motor vehicle, it is obvious that it is only those auto mechanic that posses specialized skills that will survive in the auto mechanic job in the long term.

The product life cycle for automobile continues to shorten due to competitive market pressures. This is so because competitive market force have caused auto dramatically redesign car models every four to five years. New technological developments have led to unique and innovative designs for future automobile .alternative fuel technologies such as electric hybrids and fuel cell cars have received considerable attention. International Trade commission (ITC, 2002). Wikipedia (2007) reveals that the big three auto market in United state of America such as General motors, ford and Chrysler and other automobile like Honda and Toyota have

gradually began to manufacture hybrid vehicles-hybrid vehicles combine two or more source of power, which are able to operate using rechargeable battery and gasoline. It has to be noted that Japanese auto market Toyota is one of the auto industries leaders in hybrid vehicle research and production with the introduction of its prices model.

Salami (2007) pointed out that ford motor company has invented a lot in research and development (R and D) to produce more alternative fuel vehicles and these involved

Developing a hybrid vehicle which will switch between gasoline power and will achieve fuel economy.

Developing fuel cell that will run on hydrogen and produce only water as a buy product.

Developing more efficient and cleaner diesel powered engine.

Recently many automobiles are increasingly relying on more advanced electronics, computer and wireless communication system to assist driver and enhance safety. These technologies replace mechanical system that power, steer and brake of the vehicle.

For instance:-

General Motors (GM) has introduce the autonomy concept model which uses hydrogen fuel cell technology that powers electric motors in each wheel. The vehicle uses a chassis and replaceable body. Allowing greater flexibility and freedom in designing the interior. The vehicle operates using sophisticated computer and electronic system. Voice activation is another technology being developed for use in vehicles. Voice activation systems operate internal climate controls, open doors and respond to navigational request by the driver. New development in the automobile electronic and communication technology is vehicle sensor technology. A

sensor technology uses radar or laser technology to control system that detect vehicle in front which then automatically slow down the vehicle. (Salami, 2007).

Mandall (1986) commented that to be prepared to cope with changes technology brings, computer literacy must be emphasized in training centers. He believed strongly that computer plays important role in our life and it has proven to be true because there is hardly any area of the society that have not been affected by this technology. Such area include, manufacturing, construction, production and automobile service industry to mention a few. They have fully embraced the use of computer as a means of carrying out their various activities.

Adeniba (1996) drew our attention to the dynamic nature of computer technology and stated that, a nation that will exist in this technology age must not operate below a particular level of computer literacy and usage. Therefore our work force must be exposed to the use of computer, in order to meet the challenges at stake. No technological improvement will reject the use of computer education.

Adeyemo (1995) stated that we are training children that will later be absorbed society that have already moved ahead of them and if we fail to do our work in the area of innovation i.e computer technology, we will end up creating a lot of problems for technicians of tomorrow. The said problem is for technicians and the society at large. In the absence of required work skills, technicians skills are obsolete and unemployed. This unhealthy situation compelled

Ukpongson (1997) to lament that unemployment breed; poverty gives birth to frustration, frustration produces restlessness which in turn leads to maladjustment and committing of criminal offenses and other related vices. These put master craftsmen on their toes to bread craftsmen that are equal to the task to avoid these social vices.

Gomwalk (1990) emphasized that this lack of coordination has often resulted into wrong approach to the innovation and acquisition of technology appropriate to our state of development and need of society. Obviously this coordination can be achieved if necessary satisfaction in terms of work ethics and incentives are given to master craftsmen or master trainers.

The satisfaction according to technology trainer among all is recognition of trainer to vocation. Government should relief their suffering by given them incentives and loan. This will help them to expand their business and provide accommodation for the trainees.

According to Nryston (1977) it is believed that innovation is a key element to success in any enterprise. In technology education there are numerous reasons why innovation is necessary to meet the need which is realization that technology education must in some measure contribute to the preparation of young people if in a society, increasingly pervaded by technology feats by way of using multi diagnostic tool to identify result in engine and correct it. At early age of youth, it is always easy and obvious for skill to be acquired and turn out youth with increased initiative of technological advancement.

Peugeot product and their diagnostic point Peugeot 307 hdi, diagnostic plug is on the right hand side, there is a cover over where you can adjust the light take. Remove the astray from the compartment below. Peugeot 307 SN; the diagnostic plug is located just under the dash board on the driver's side, it's under a flap. Peugeot 207. The diagnostic plug is besides the fuse on the passenger's side of a right hand driver car. Peugeot 307 test the diagnostic socket on Peugeot 307 test is under the ash tray (behind the gear).

Concept of automobile diagnostic

Performing a car diagnostic can reveal a number of problems associated with the transmission, oil tank, gas tank, exhaust system and other component of the vehicle. Modern vehicle designed with computer processor micro chips and sensors can be linked to a car diagnostic computer scan to pinpoint exactly where the problem exists. The scans are performed at a dealership or ta the garage of certified mechanic. Some scans can be perform at home using a hand held scaaing devices.

History

According to popular mechanic in 1996 the EPA mandated that the computer interface of all vehicles sold in the united state had to meet the on-board diagnostic, version two (OBD) standard. This meant that after market repair shops would be able to diagnose a problem in the vehicle using only on set of tools and running a simple computer scan. This is now know as the car diagnostic test, the process involve producing a computer report with a set of code that pertain to different problem.

Effects

The car diagnostic can tell you the following about the Peugeot vehicle: ignition timing issues, level of buildup in the combustion engine, fuel injector performance whether the ignition coils are firing, engine rpm levels air and coolant temperature. Crankshaft and camshaft position and the throttle opening. After the car diagnostic is performed, the computer will tag each data point to reveal what need to be corrected and stores this code so that the technician can look in a specific area for the problem

Common Diagnostic codes

According to car2pro.com, OBD II diagnostic trouble code can range from P0100 to P1899 each letter and number in the code represents a different part of the vehicle. The first letter is often a "P" which relate to power train, if it is a "B" it will relate to the body, a "C" relate to the chassis and a "U" is undefined. The no zero (0) in the second place holder is a generic code shared by all manufacturer, but some manufacturers use a specific code here so the number one (1) means there is a fuel or air problem two (2) means there is something wrong with the injector circuit, three (3) means is an ignition problem or the engine is misfiring, four (4) means there is an emission control problem, five (5) means there is a vehicle speed or idle control problem, six (6) means there is a computer or output circuit problem, seven (7) or an eight (8) there is a transmission problem. The fourth and fifth digit of the computer diagnose check report further identify which system is malfunction the digits that appear here U any by vehicle maker, so the mechanic running the test may need to contact the dealership or do some research on what the rest of the code means.

Benefits

Performing a car diagnostic testing using an auto scan tools can save the mechanic a lot of time troubleshooting a problem and also save the car owner money because they don't have to pay for a complete mechanical check at their local repair shop, when the "check engine" light appears in the dashboard, the car owner has the idea of what could be the problem. running a computerized car diagnostic check can highlight the problem so that the mechanic can fix only what needs to be fixed. Most car diagnostic check can be performed in under an hour.

Approach for automobile diagnose

Wikipedia (2009) defines diagnostic as the identification of the nature and cause of anything in the use of a logical analytics and experience to determine the cause and effect relationships. In system engineering it is typically use to determine the cause of system, mitigation for problems and solution to issues.

Engine fault diagnosis is a field of automobile that concerned with finding fault arising in engine. One of the most common problems encounter by an engine is inability of the technician to diagnose the engine problem. As a result of using fault diagnostic to meet industrial need in a cost effective way and to reduce maintenance cost without requiring more investment than the cost of what is to be avoided in the first place.

This is the subject of maintenance, repair and operation. Fault diagnostic is usually industrial practice that need to be applied according to guide line. This need arises from the fact that diagnostic on their own may be capable of saving a single machine or equipment from getting damage.

Steps involve in diagnostic are:

- Verify the complaint.
- Determine related symptoms.
- Analyses your observation.
- Isolate the problem.
- Correct the problem.
- Verify the repair.

Accurate electrical diagnose is one of the most difficult challenges to be faced when working on today's automobile. Considering the large number of system that use electricity in other to operate, been able to quickly diagnose electrical problem. can be a real asset whether you are attempting to diagnose an engine control issue, an automatic ride height system or a power window issue, the electrical system all utilize the same principle. Often, diagnosing electrical problem in automobile is more mental work that is in turning wrench.

Peugeot vehicle or product may be difficult to diagnose, many of these challenges can be eliminated by carefully following a well laid down approach. The key to any diagnostic approach is to follow the steps in order, skipping or performing the steps in a different sequence can result in extended repair, time and tremendous frustration

How to diagnose a Peugeot vehicle (504)

- i. Disable the fuel system by removing the fuel pump fuse or relay
- ii. Remove the spark plug wires one at a time and insert a small screw driver into the wire
- iii. Remove the distributor cap
- iv. Turn the engine key on but do not crank the engine
- v. Locate the negative or ground wire attached to the engine coil
- vi. Ask someone to crank the engine which watching the test light

New approach for automobile diagnostic and repairs

Today's automobile rely upon electronics and computer to control and monitor all aspects of vehicle operation such as speed, engine revolution per minute (RPM), coolant temperature and oxygen sensor. (Wikipedia, 2010). William and Donald (2007) reveal that modern automobile contains numerous on board computer chips ehich work in collaboration with the automobile

electronic control unit (ECU) to monitor and control many system such as the engine, transmission, power train, airbags and antilock brake.

The electronic control unit or module (ECU/ECM) is the automotive system computer that receives information or signals from sensor and is programmed to centrally operate various systems, circuits, and actuators based on the information received. Sensors are input devices that converts physical conditions into electrical signals from the ECU into mechanical motion (Salami, 2004) while driving, if the vehicle's on board computer system detects a problem, the driver is informed using the "check engine" or "service engine soon" light on the vehicles dash board. This light is also known as the malfunction indicator light (MIL). When this light illuminates, a diagnostic trouble code is saved into the computer memory, ready for a scan tool to read the value and diagnose appropriately (Khumi and Gupta, 2007).

Scan tool: A scan tool is a device used to access on board diagnostic (OBD) information from the automotive computer memory. (Kirpal, 2006). There are different sizes and shapes of scan tools. The two basic types of scan tools are the "stand alone" scan tool which do not require a computer and the "personal computer" (PC) based scan tools which requires a computer for it's operation.. Scan tools functions only if it has a good diagnostic software's which cost about N 10,000. To N 15,000. A scan too cost between N100,000 to 300,000 depending on the capacity or number of vehicle makes and model it can diagnose and repair.

Importance of scan tool: Hillier and Rogers (2007) reveals the following about the importance of scan tools: the scan tool help the auto mechanic to read diagnostic trouble code (DTC) reported by the ECU. DTC is a combination of alphabet and numbers which the ECU displays when there is a fault in the vehicle. The scan tool displays in real time, the value measured by

any sensor. For instance, the diagnostic trouble code P0503 means (vehicle speed sensor intermittent).

- Even if you don't repair the vehicle yourself, knowing the DTC number before taking the vehicle in for repair makes you an informed consumer. For example, if the DTC indicates a faulty vehicle speed sensor, and the auto mechanic talks about brake failure or engine overhaul, you will know the auto mechanic is wrong and therefore, you will want a second opinion before leaving the vehicle for repair. It helps consumers to assess the job skills and competencies possessed by auto mechanics.
- Scan tool is used for checking or evaluation when purchasing a used or 2nd hand vehicle to discover any possible mechanical or electrical problems
- Once the vehicle is repaired, the scan tool can be used to erase the diagnostic trouble code and to extinguish the check engine light.
- A scan tool reads codes, clears codes and can tell which parts need to be replaced. It can be used for advanced diagnostics work.
- Code reader: A code reader is a diagnostic tool that can access and display codes and also read diagnostic trouble codes. A code reader can also clear codes and turn off the malfunction indicator light (MIL). Rajput (2007) reveals that a code reader cannot be used for advanced diagnostic work because a code reader itself cannot tell you which parts need to be replaced. Therefore, he recommends a scan tool for advanced diagnostics work and trouble shooting. Trouble shooting in motor vehicle is the process of finding faults in a vehicle.

On board diagnostic (OBD): According to Wikipedia (2009) on board diagnostic (OBD) in an automotive context, is a generic term referring to a vehicle's self diagnostic and reporting

capacity. OBD is a computer based system found on most modern vehicles, whose main function is to control and monitor the emission levels. Duffy and Smith (1992) pointed out that, it was the introduction of on board computers on vehicle in 1980 that made on board diagnostics (OBD) possible. Google books (2010) reveal that there are three version of OBD: OBD-1, OBD-1.5 and OBD-11. OBD11 is an improvement over OBD-1 in both capability and standardization OBD 1.5 is an hybrid of OBD 1 and OBD 11. OBD-1. Was an encouragement for auto useful life. It was also reveal that OBD-111 is in the regulatory development phase and involves more advance emission control and report capabilities. Scan tools that are compatible with OBD-11 are called OBD-11 scan tools and can either be stand alone or PC based OBD 11 scan tools. European on-board diagnostics (EOBD) is a version of OBD-11 scan model year 2003 for diesel vehicles and since 2001 for gasoline vehicle while Japan on board diagnostics (JOBD) is a version of OBD-11 for vehicles sold in Japan (Hillier and Coombes, 2004).

OBD compatibility: Hillier, coombes and rogers (2006) reveals that it is only vehicles having OBD 11 certified logo under their hood (bonnet) that can be diagnose, repair and maintain using OBD 11 scan tools. Some old vehicle made in 1980 and above are OBD 11 certified while some are not.to know if your vehicle is OBD 11 complaint, lift the hood (bonnet) and look for the OBD 11 certified sticker below:

Somw 1994 and 1995 model are also supported. To see if your vehicle is compliant, pop the hood and look for this sticker:

Model year 1996 and newer vehicle are compliant by default, and will not have this sticker.

To use scan tool, the can tool is plug through the electric connector into a standardized socket usually under the dashboard in the driver corner or in the vehicle hood (bonnet). Most scan tool use for diagnostics are portable hand-held scan tools.

National automotive council (NAC): the national automotive council is a product of the national automotive policy established in 1993 to regulate, monitor and control the activities in the automotive industry in Nigeria. It ensures standardization of technological practices in Nigeria within the automotive industry (FRN, 1993).

Automotive service excellence (ASE): The national institute for automotive service excellence (ASE) was established in 1972 in America to regulate, and improve the Quality of vehicle repair and service through the testing and certification of repair and services of automotive technician all over the world. the ASE certified technicians are highly respected in automotive service industry and gets more job and pay. The (ASE) certificate enables consumers to distinguish between competent automotive technicians.

Summary of literature reviewed

The growth and development of automobile were discussed. The literature stressed out the problem encounter when diagnosing an automobile engine fault, various steps that could be taken to make automobile engine fault diagnostic easier were emphasized. The importance of automobile engine fault diagnostic were discussed. The literature stated how automobile engine could be diagnosed. The literature stated the strategic point were diagnostic plug could be located in Peugeot vehicles. The six stages of automobile engine fault diagnostic were discussed. The chapter stressed out various tools that can be used in automobile engine diagnostic and how they can be used.

CHAPTER THREE

METHODOLOGY

This chapter describe the research design, Area of study, Population, Sample, Instrument for Data Collection, Validation of Instrument, Administration of the Instrument, Method of Data Analysis and Decision rule.

Research Design

A survey research design was adopted for this study. The survey design was considered the best design for this study because of the type of information needed for this investigation. Olaitan and Nwoke (1999) define a survey as a descriptive study in which the entire population or representation sample of the entire population is studied by collecting and analyzing data from the group through the use of questionnaire. Therefore the survey design was considered suitable since the s will seek information from a sample that was drawn from a population using questionnaire That study seek the opinion of Peugeot staffs and Peugeot users in Minna and Kaduna regarding this project will concentrate on Diagnostic approach in solving automotive engine problems Peugeot as a case study.

Area of study

The study was conducted in Minna and Kaduna to determine the diagnostic approach in solving automotive engine problems Peugeot as a case study.

Population of the study

The targeted population for the study consist of Peugeot users and staffs in both Kaduna and Niger state this is shown on the table below

Table1: below shows the population of staff of Peugeot Automobile of Nigeria (Pan) Limited, Kaduna, staff of kaura/danali motors minna and Peugeot users of both Kaduna and minna all the various companies as listed

| Respondent | Kaduna/Minna |
|--|--------------|
| Staff of Peugeot Automobile of Nigeria (Pan) Limited, Kaduna | 300 |
| Users of Peugeot Kaduna | 230 |
| Staff of Kaura/Danali Motors Minna | 10 |
| Users of Peugeot Minna | 100 |
| Sum of total | 640 |

Table formulated by the researcher

Sample of study

A total number of three hundred (300) Peugeot staff and Peugeot users were randomly selected from the two area of the study as sampled:

Instrument for data collection

The instrument for data collections was a structured questionnaire designed by the researcher. The questionnaire contained 30-items questions which sought responses to such factors like: What are the problems faced by automobile technicians in diagnosing automotive engine fault, How can the problems faced by automobile technician in diagnosing automotive engine fault be eliminated and What are the diagnostic approach to be adopted by automobile technician in solving automotive engine problems. The questionnaire contains two sections, A and B. section A contains personal data of both Peugeot staffs and Peugeot users while section B

comprises of 30-item under the following sub-learning or section. Questions and responses made is on a four-point rating scale of strongly agree (S.A), agree (A), Disagree (D) and Strongly Disagree (S.D).In the questionnaire, respondents were requested to indicate by ticking (✓) against the most appropriate options in the space provided in the response column

Validation of instrument

The instrument was designed by the researcher and was given to the project supervisor and two other lecturers in the department of industrial and technology education; for validation

Administration of the instrument

The instrument was administered personally to the respondents by the researcher with the aid of research assistance.

Method of data analysis

The data collected by the researcher was analyzed using mean, standard deviation and t-test as statistics tools. The mean will be used to determine the level of agree and disagree of research questions, while t-test will be used to test the hypothesis of the study.

Decision rule

To determine the acceptance level of 2.50 will be the decision points. The item with mean response of 2.50 and above will be considered to agree or accepted while an item with a mean response 2.49 and below will be disagree or rejected.

CHAPTER IV

PRESENTATION AND DATA ANALYSIS

This chapter deals with the presentation and analysis of data with respect to the research questions formulated for this study, the result of this data analysis for the research questions are presented as follows.

Research Question 1

What are the problems faced by automobile technicians in diagnosing Peugeot automotive engine fault.

Table 1: Mean responses of Peugeot users and staffs on the problems faced by automobile technicians in diagnosing Peugeot automotive engine fault.

$N_1=220,$

$N_2=180$

| S/N | ITEMS | X_1 | X_2 | X_t | Remarks |
|-----|---|-------|-------|-------|---------|
| 1 | They lack modern diagnostic repair equipment . | 2.98 | 2.99 | 2.99 | Agree |
| 2 | They lack knowledge of on-Board diagnostics techniques. | 3.29 | 3.17 | 3.23 | Agree |
| 3 | They lack skills in the use of scan tools in maintenance work | 3.25 | 3.17 | 3.21 | Agree |
| 4 | They can't interpret diagnostics troubleshooting codes | 3.37 | 3.36 | 3.37 | Agree |
| 5 | Inability to read the code reader to trace faults in modern cars. | 3.22 | 3.22 | 3.22 | Agree |
| 6 | They lack skills in the use of modern troubleshooting device. | 3.15 | 3.14 | 3.15 | Agree |
| 7 | The complexity of computers in modern cars is confusing. | 3.17 | 3.23 | 3.20 | Agree |
| 8 | They lack knowledge of the electronics safety devices in modern cars. | 3.12 | 3.10 | 3.11 | Agree |
| 9 | They lack knowledge of OBDII certification. | 3.22 | 3.32 | 3.27 | Agree |
| 10 | They are not exposed to recent automobile technology. | 3.13 | 3.19 | 3.16 | Agree |
| 11 | They are not familiar with latest diagnostic trend in automobiles. | 3.22 | 3.27 | 3.25 | Agree |

| | | | | | |
|----|---|------|------|------|-------|
| 12 | They lack knowledge on the new approach to automobile faults. They lack knowledge on the operation of automobile computer systems. | 3.33 | 3.29 | 3.31 | Agree |
| 13 | | 3.11 | 3.15 | 3.13 | Agree |

Key

N1 = Numbers of Peugeot staffs, **N2**= Numbers of Peugeot users, **X** = Mean of Peugeot staffs,

X2 = Mean of Peugeot users, **Xt** = Average mean of Peugeot users and users.

The data presented in Table one revealed that the respondents agree with all the items with mean score ranging between 2.99-3.37

Research Question 2.

How can the problems faced by automobile technician in diagnosing automotive engine fault be eliminated

Table 2: the mean responses of Peugeot users and staffs on how the problems faced by automobile technician in diagnosing automotive engine fault be eliminated

| S/N | ITEMS | X ₁ | X ₂ | X _t | Remarks |
|-----|--|----------------|----------------|----------------|---------|
| 14 | Be provided with retraining course to upgrade their skills. Purchase modern troubleshooting devices like scan tools and code readers. | 3.08 | 3.14 | 3.11 | Agree |
| 15 | Be conversant with the modern brain box for diagnosing. | 3.18 | 3.27 | 3.23 | Agree |
| 16 | Taught theoretical principles of automobile technology to Apprentices. | 3.20 | 3.28 | 3.24 | Agree |
| 17 | Develop standard form of evaluation for apprentices | 2.87 | 2.72 | 2.80 | Agree |
| 18 | Technicians should acquire training in the application of scan tool for diagnostics and repairs. | 2.89 | 2.84 | 2.87 | Agree |
| 19 | Technicians should acquire training in the use of code reader to trace fault | 3.17 | 3.20 | 3.19 | Agree |
| 20 | | 3.09 | 3.23 | 3.16 | Agree |

| | | | | | |
|----|---|------|------|------|-------|
| 21 | Technicians should acquire knowledge on how to identify automotive sensors. | 3.38 | 3.26 | 3.32 | Agree |
| 22 | Technicians should learn how to identify automobile actuators. | 3.11 | 3.14 | 3.13 | Agree |
| 23 | Technicians should understand the principles of operation of electronic control unit. | 3.20 | 3.27 | 3.24 | Agree |
| 24 | Technicians should be conversant with On-Board Diagnostics (OBD). | 3.35 | 3.31 | 3.33 | Agree |
| 25 | Technicians should be conversant with various sensors and actuators in modern cars. | 3.11 | 2.92 | 3.02 | Agree |
| 26 | | 3.19 | 3.12 | 3.16 | Agree |
| 27 | Technicians should be able to identify OBD-II certified vehicles. | 3.50 | 3.55 | 3.53 | Agree |
| 28 | The technicians should be able to utilize the Vehicle Identification Number (VIN) to ensure accurate replacement of components. | 3.40 | 3.44 | 3.42 | Agree |

The data presented in Table one revealed that the respondents agree with all the items with mean score ranging between 2.80-3.53

Research Question 3

What are the diagnostic approach to be adopted by automobile technician in solving automotive engine problems.

Table 3: the mean responses of Peugeot users and staffs on are the diagnostic approach to be adopted by automobile technician in solving automotive engine problems.

| S/N | ITEMS | X ₁ | X ₂ | X _t | Remarks |
|-----|--|----------------|----------------|----------------|---------|
| 29 | Conduct engine performance test and determine needed repair. | 3.07 | 3.19 | 3.13 | Agree |
| 30 | Diagnose and carry out needed repairs on multiplex electrics and wiring: signal and current flow controls. | 2.95 | 3.08 | 3.02 | Agree |
| 31 | Perform oil and lubricant service on normally aspirated and | 3.12 | 3.18 | 3.15 | Agree |

| | | | | | |
|----|--|------|------|------|-------|
| | turbocharged engines. | | | | |
| | Perform on –board computer diagnostic on electronic control | | | | |
| 32 | unit. | 3.13 | 3.08 | 3.11 | Agree |
| | Checking coolant temperature warning lamp function via | | | | |
| 33 | electronic control unit. | 3.14 | 3.09 | 3.12 | Agree |
| | Checking diagnostic warning light control function via | | | | |
| 34 | electronic control unit. | 3.42 | 2.67 | 3.05 | Agree |
| | Checking engine speed sensor function via electronic control | | | | |
| 35 | unit. | 3.39 | 3.00 | 3.20 | Agree |
| | Diagnose electronic injection system faults and determine | | | | |
| 36 | needed repairs. | 3.40 | 3.23 | 3.32 | Agree |
| | Inspect, repair or replace electronic ignition components when | | | | |
| 37 | required. | 3.40 | 3.25 | 3.33 | Agree |
| 38 | Check mixture regulation function via electronic control unit. | 3.41 | 3.29 | 3.35 | Agree |

The data presented in Table two revealed that the respondents agree with all the items with mean score ranging between 3.03-3.35

FINDINGS

Based on the data collected and analyzed, the following findings were made according to the research questions raised for the study.

Findings related to the problems faced by automobile technicians in diagnosing Peugeot automotive engine fault. Both respondents agreed with the following.

1. They lack modern diagnostic repair equipment
2. They lack skills in the use of scan tools in maintenance work
3. They lack skills in the use of modern troubleshooting device.

Findings related to how the problems faced by automobile technician in diagnosing automotive engine fault be eliminated. Both respondents agreed with the following.

1. They lack skills in the use of modern troubleshooting device.
2. Taught theoretical principles of automobile technology to Apprentices.
3. Technicians should acquire training in the application of scan tool for diagnostics and repairs.

Findings related to the diagnostic approach to be adopted by automobile technician in solving automotive engine problems. Both respondents agreed with the following.

1. Conduct engine performance test and determine needed repair.
2. Diagnose and carry out needed repairs on multiplex electrics and wiring: signal and current flow controls.
3. Checking diagnostic warning light control function via electronic control unit.

DISCUSSION OF THE FINDINGS

The discussion of the findings are based on the research questions raised for the study.

Findings from table 2 indicated that they lack modern diagnostic repair equipment. The view of the respondents agree with Adeniba (1996) who drew our attention to the dynamic nature of computer technology and stated that, a nation that will exist in this technology age must not operate below a particular level of computer literacy and usage. Therefore our work force must be exposed to the use of computer, in order to meet the challenges at stake. No technological improvement will reject the use of computer education.

The findings also indicated that they lack skills in the use of scan tools in maintenance work. This is in line with Nryston (1977) who believed that innovation is a key element to success in any enterprise. In technology education there are numerous reasons why innovation is necessary to meet the need which is realization that technology education must in some measure contribute to the preparation of young people in a society, increasingly pervaded by technology feats by way of using multi diagnostic tool to identify result in engine and correct it. At early age of youth, it is always easy and obvious for skill to be acquired and turn out youth with increased initiative of technological advancement.

The findings also revealed that they lack skills in the use of modern troubleshooting device. This also agree with Amitabh (2009) who defined innovation as the exploitation of new ideas leading to the creation of a new product, process or services. He further stated that it is not just the invention of a new idea that is important, but it is actually bringing it to market, putting it into practice and exploiting it in a manner that lead to new products, services or systems that add value or improve quality it possibly involves technological transformation and management restructuring. Innovation also means exploiting new technology and employing out of the box thinking to generate new value and to bring about significant changes in society.

Findings from table 3 indicated that They lack skills in the use of modern troubleshooting device. According to car2pro.com, OBD II diagnodtic trouble code can range from P0100 to P1899 each letter and number in the code represents a different part of the vehicle. The first letter is often a "P" which ralate to power train, if it is a "B" it will relate to the body, a "C" relate to the chassis and a "U" is undefined. The no zero (0) in the second place holder is a generic code shared by all manufacturer, but some manufacturers use a specific code here so the number one (1) means there is a fuel or air problem two (2) means there is something wrong with the injector

circuit, three (3) means is an ignition problem or the engine is misfiring, four (4) means there is an emission control problem, five (5) means there is a vehicle speed or idle control problem, six (6) means there is a computer or output circuit problem, seven (7) or an eight (8) there is a transmission problem. The fourth and fifth digit of the computer diagnose check report further identify which system is malfunction the digits that appear here U any by vehicle maker, so the mechanic running the test may need to contact the dealership or do some research on what the rest of the code means.

The findings also indicated that they should be taught theoretical principles of automobile technology to Apprentices. This is in line with Adeyemo (1995) who said we are training children that will later be absorbed society that have already moved ahead of them and if we fail to do our work in the area of innovation i.e computer technology, we will end up creating a lot of problems for technicians of tomorrow. The said problem is for technicians and the society at large. In the absence of required work skills, technicians skills are obsolete and unemployed. This unhealthy situation compelled and also supported by Mandall (1986) commented that to be prepared to cope with changes technology brings, computer literacy must be emphasized in training centers. He believed strongly that computer plays important role in our life and it has proven to be true because there is hardly any area of the society that have not been affected by this technology. Such area include, manufacturing, construction, production and automobile service industry to mention a few. They have fully embraced the use of computer as a means of carrying out their various activities.

The findings also revealed that technicians should acquire training in the application of scan tool for diagnostics and repairs. This was supported by Hillier and Rogers (2007) who reveals the following about the importance of scan tools: the scan tool help the auto mechanic to

read diagnostic trouble code (DTC) reported by the ECU. DTC is a combination of alphabet and numbers which the ECU displays when there is a fault in the vehicle. The scan tool displays in real time, the value measured by any sensor. For instance, the diagnostic trouble code PO503 means (vehicle speed sensor intermittent).

Findings from table 4 indicated that Conduct engine performance test and determine needed repair. This is in agreement with Wikipedia (2009) defines diagnostic as the identification of the nature and cause of anything in the use of a logical analytics and experience to determine the cause and effect relationships. In system engineering it is typically use to determine the cause of system, mitigation for problems and solution to issues. And supported by The national institute for automotive service excellence (ASE) was established in 1972 in America to regulate, and improve the Quality of vehicle repair and service through the testing and certification of repair and services of automotive technician all over the world. the ASE certified technicians are highly respected in automotive service industry and gets more job and pay. The (ASE) certificate enables consumers to distinguish between competent automotive technicians.

The findings also indicated that diagnose and carry out needed repairs on multiplex electrics and wiring: signal and current flow controls. This is in line with Rajput (2007) reveals that a code reader cannot be used for advanced diagnostic work because a code reader itself cannot tell you which parts needs to be replaced. Therefore, he recommends a scan tool for advanced diagnostics works and trouble shooting. Trouble shooting in motor vehicle is the process of finding faults in a vehicle.

The findings also revealed that checking diagnostic warning light control function via electronic control unit. Today's automobile rely upon electronics and computer to control and monitor all aspects of vehicle operation such as speed, engine revolution per minute (RPM), coolant temperature and oxygen sensor. (Wikipedia, 2010). William and Donald (2007) reveal that modern automobile contains numerous on board computer chips ehich work in collaboration with the automobile electronic control unit (ECU) to monitor and control many system such as the engine, transmission, power train, airbags and antilock brake.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of the Study

Diagnosing engine fault is an important factor that need to be considered in order to reduce the lost of repairing and restoring an engine.

The automobile industries dwell on innovation continuously by carrying out research and development to bring about better automobile products to satisfy the dynamic nature of human needs. With the stress on the part of automobile technicians has lead to the invention of diagnostic equipment with high level of electronic dictating device.

The study used a survey research approach to find out the problems faced by automobile technicians in diagnosing Peugeot automotive engine fault, the problems faced by automobile technician in diagnosing automotive engine fault be eliminated and the diagnostic approach to be adopted by automobile technician in solving automotive engine problems.

Thirty eight (38) item were generated in the questionnaire to elicit Peugeot user and staffs resposes and the questionnaire was validated by 3 lecturers in the Department of Industrial and Technology Education. A total of 300 validated questionnaire were issued to 220 Peugeot staff and 180 Peugeot users in Kaduna and Niger state. The instrument for data collection was analyzed using mean, standard deviation and t-test.

Implication of the Study

It could be deduced from the study that diagnosing in automobile adversely affects the individual who have little or no knowledge of how to use diagnostic equipment in solving engine problem. This imply that the problems faced by automobile technicians in diagnosing Peugeot automotive engine fault and the diagnostic approach to be adopted by automobile technician in solving automotive engine problems

Conclusions

In conclusion, it was discovered from the study that the diagnostic approach in solving Peugeot automobile engine problems can be solved by encouraging technicians to improve their skills on OBD computer and the troubleshooting this as stated by car2pro.com, OBD II diagnodtic trouble code can range from P0100 to P1899 each letter and number in the code represents a different part of the vehicle. The first letter is often a "P" which relate to power train, if it is a "B" it will relate to the body, a "C" relate to the chassis and a "U" is undefined. The no zero (0) in the second place holder is a generic code shared by all manufacturer, but some manufacturers use a specific code here so the number one (1) means there is a fuel or air problem two (2) means there is something wrong with the injector circuit, three (3) means is an ignition problem or the engine is misfiring, four (4) means there is an emission control problem, five (5) means there is a vehicle speed or idle control problem, six (6) means there is a computer or output circuit problem, seven (7) or an eight (8) there is a transmission problem. The fourth and fifth digit of the computer diagnose check report further identify which system is malfunction the digits that appear here U any by vehicle maker, so the mechanic running the test may need to

contact the dealership or do some research on what the rest of the code means. Therefore if technicians can improve on the above mention codes and techniques the problems faced by most of them would be a thing of the past.

Recommendations

1. Federal government should set up a technical programme that will see to the improvement of automobile technicians.
2. Technicians should be encourage to buy the diagnostic equipment to facilitate their job.
3. Auto professional and expert should teach the technicians how to identify on-board diagnostic (OBD) device such as sensors and actuators.
4. National automotive council (NAC) should organize periodic training courses for auto technicians.
5. Technicians should be taught how to identify input and output devices in the modern vehicles which are linked to the electronic control unit.

Suggestion for Further Research

1. Develop a curriculum for the training of automobile technicians.
2. Tracking devices in modern automobile engines as a means of reducing theft in Nigeria.
3. Problem militating against auto technician in relation to the on-board diagnostic equipment in auto industries.
4. Challenges of automobile diagnostic technology on the financial state of automotive technician.

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APPENDIX II

QUESTIONNAIRE FOR PUEGEOT STAFFS AND PUEGEOT USER OF BOTH KADUNA AND NIGER STATE, NIGERIA

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA NIGER STATE, SCHOOL OF SCIENCE AND
SCIENCE EDUCATION

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION

This research work is on Diagnostic approach in solving automotive engine problem. Peugeot as a case study.

Introduction: please provide the following information before completing the questionnaire.

Section A

Personal data

Status: Peugeot user []

Peugoet staff []

Section B. C and D below are research questions and their items. Kindly indicate by a tick i.e. [√] against each statement in the appropriate Colum which described the extent to which you agree with statement by using the following key:

SA—Strongly Agree

A—Agree

D—Disagree

SD—strongly disagree

SECTION B:

Research question 1

What are the problems faced by automobile technicians in diagnosing automotive engine fault

| S/N | STATEMENT OF ITEMS | SA | A | D | SD |
|-----|--|----|---|---|----|
| 1 | They lack modern diagnostic repair equipment . | | | | |
| 2 | Lack knowledge of on-Board diagnostics techniques. | | | | |
| 3 | Lack skills in the use of scan tools in maintenance work | | | | |
| 4 | They can't interpret diagnostics troubleshooting codes | | | | |
| 5 | Cannot use the code reader to trace faults in modern cars. | | | | |
| 6 | Lack skills in the use of modern troubleshooting device. | | | | |
| 7 | The complexity of electronics and computers in modern cars is confusing. | | | | |
| 8 | Lack knowledge of the electronics safety devices in modern cars. | | | | |
| 9 | Lack knowledge of OBDII certification. | | | | |
| 10 | They are not exposed to recent automobile technology. | | | | |
| 11 | They are not familiar with latest diagnostic trend in automobiles. | | | | |
| 12 | Lack knowledge on the new approach to automobiles fault. | | | | |
| 13 | There lack knowledge on the operation of automobiles computer system. | | | | |

SECTION C:

Research question 2

How can the problems faced by automobile technician in diagnosing automotive engine fault be eliminated

| S/N | STATEMENT OF ITEMS | SA | A | D | SD |
|-----|---|----|---|---|----|
| 1 | Periodic retraining course should be organized for technicians to upgrade their skills. | | | | |
| 2 | Technicians should purchase modern troubleshooting devices like scan tools and code readers. | | | | |
| 3 | Technicians should acquire training in the application of scan tool for diagnostics and repairs. | | | | |
| 4 | Technicians should acquire training in the use of code reader to trace fault | | | | |
| 5 | Technicians should acquire knowledge on how to identify automotive sensors. | | | | |
| 6 | Technicians should learn how identify automobile actuators. | | | | |
| 7 | Technicians should understand the principles of operation of electronic control unit. | | | | |
| 8 | They should be conversant with the modern brain box for diagnosing. | | | | |
| 9 | Apprentices should be taught theoretical principles of automobile technology. | | | | |
| 10 | Technicians should be conversant with on-Board diagnostics (OBD). | | | | |
| 11 | Technicians should be conversant with various sensors and actuators in modern cars. | | | | |
| 12 | A standard form of evaluation should be developed for apprentices | | | | |
| 13 | Technicians should be able to identify OBD-II certified vehicle. | | | | |
| 14 | The technicians should be able to utilize the vehicle identification Number (VIN) to ensure accurate replacement of components. | | | | |
| 15 | Technicians should be familiar with the input and output devices linked the automobile computer in modern cars. | | | | |

SECTION D:

Research 3

What are the diagnostic approach to be adopted by automobile technician in solving automotive engine problems.

| S/N | STATEMENT OF ITEMS | SA | A | D | SD |
|-----|--|----|---|---|----|
| 1 | Conduct engine performance test and determine needed repair. | | | | |
| 2 | Diagnostic and carry out needed repairs on multiplex electrics and wiring: signal and current flow controls. | | | | |
| 3 | Perform oil and lubricant service on normally aspirated and turbocharged engines. | | | | |
| 4 | Perform on –board computer diagnostic on electronic control unit. | | | | |
| 5 | Checking coolant temperature warning lamp function via electronic control unit. | | | | |
| 6 | Checking diagnostic warning light control function via electronic control unit. | | | | |
| 7 | Checking engine speed sensor function via electronic control unit. | | | | |
| 8 | Diagnose electronic injection system faults and determine needed repairs. | | | | |
| 9 | Inspect, repair or replace electronic ignition components when required. | | | | |
| 10 | Checking mixture regulation function via electronic control unit. | | | | |

