# Diagnostic skills in Lubricating System for Effective Fault Detection in Automobile Engines among Students in Rivers State Tertiary Institutions

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***Abstract*: This study diagnosed skills in lubricating system for effective faults detection in automobile engines among students in Rivers State tertiary institutions. Specifically, the study examined the components of lubricating system, skills needed for faults associated with lubricating system detection and the causes of the faults associated with lubricating system for effective fault detection in automobile engines in Rivers State tertiary institutions. The population of the study was 91 respondents which comprised 27 automobile lecturers and 64 final year students in mechanical technology department. No sample was done as the population was manageable; therefor census technique was adopted. The instrument used for data collection was a self-made survey questionnaire. The instrument was validated by two experts in the department of Vocational and Technology Education in Rivers State University, Port-Harcourt. The reliability of the instrument was established using test re-test, Pearson Product Moment Correlation. The coefficient achieved was .82. Mean was used to answer the research questions, while Standard Deviation was used to ascertain the homogeneity of responses, and z-test was used to test the null hypotheses at .05 significance level. The study found among others that lubricating system could be associated with different faults such as leakages, high oil consumption, abnormal engine noise; oil filters swells and others which could be cause by, over greasing, leaking gaskets, worn cylinder, worn piston. Therefore, it was recommended among others that there should be proper orientation programme for students at automobile workshop so as to intimate students on the causes and skills needed for faults detection on lubricating system, so that students do not fall victim of defaulting the rules of lubrication**

***Keywords*: Automobile Engine, Diagnosis, Fault detection, & Lubricating System.**

## I. INTRODUCTION

Despite the fact that there has been definite rise of petroleum products in recent times in Nigeria, we cannot just go back to the time when people resort to ancient method of transportation using animal-driven carts. Automobile is one innovation in the world that helps in solving human stress and time of moving from one place to another. They are necessary as people move from one place to another for their livelihood, correspondence etc Giri (2012) described automobile as a self-propelled vehicle used for transportation of goods and passengers on land. Hence, automobile could be described as an innovation that facilitates the movement of humans, animals and different kinds of goods (Uka & Ochogba, 2020). However, there are different types of automobile that is evident either in the design of the chassis or the engine of the automobile. Giri (2012) categorized the modern automobile into two distinct sub-assemblies such as the body and the chassis.

The body includes the passengers compartment, the trunk, the bumpers, the fenders, the radiator grill, the hood, the interior trim, glass and paint while the chassis is the assembling of a body without body such as frame, wheels, axles, springs, shock absorbers, engine, clutch, gearbox, propeller shaft and universal joints, differential and half shafts, steering, brakes and accelerator, fuel tank, storage battery, radiator and silencer (Giri, 2012). For an automobile to function effectively, these parts must operate as expected (Mekonnen, & Mahmut, 2018). Meanwhile, for most of the parts that make up the chassis to function effectively, they have to be lubricated through the lubricating system.

Lubrication is the science of reducing friction between two solid bodies in relative motion by interposing a lubricant between their rubbing surfaces. Okwelle, Beako, & Ajie (2017) opine that lubrication is the most vital singular factor in auto maintenance. It keeps the auto parts young; contribute to better profits by improving the life of the wear components, equipment availability and reliability. Therefore, lubricating system could be described as the part of an automobile that helps in reducing friction between surfaces by interposing a lubricant between the surfaces in contacts (Vishwakarma, 2015). In this context, lubricating system could be described as a system in automobile that reduces friction between moving parts through the use of lubricants. Inline this, Agam, Ankit & Mohit (2016) sees it as a system that provides metered amount of lubricant to multiple locations on a machine while the machine is operating

From the definitions of lubricating system, it could be described as an important system in automobile based on its functions. Osman (2010) opined that the lubricating system reduces friction, protects the engine against wear, contributes to cooling the piston, removes injurious impurities and holds gas and oil leakages. Similarly, Bonnick and Newbold (2011) stated that the lubricating system keeps friction and wear on the moving parts to a minimum, acts as a coolant and transfers the heat from the moving parts, keeps the moving parts clean,

reduces corrosion and noise in the engine and also acts as a sealant around the pistons and rings. Also, lubricating system serves as coolant, acts as a sealant, serves as anti-corrosive agent, removes gritty and carbonaceous deposits, cushions the parts against impact and vibration and reduces noise (Giri, 2012).

According to Saif (2020), there are six types of lubricating system such as petrol system, splash system, pressure system, semi-pressure system, dry sump system and wet sump system. The petrol system is the type that is commonly used in two strokes petrol engines. The splash system is the type that oil accumulates in an oil trough or sump. In the pressure system, engine parts are lubricated under pressure feed. The semi-pressure is the combination of a splash and pressure system. The dry sump is the type that the lubricating oil is not located in the oil sump. The wet sump system is the type of lubricating system whereby oil is transported to various engine parts with a sump strainer.

Meanwhile, lubricating system comprises of several components or parts. According to Bonnick and Newbold (2011), the main components in the lubricating system include the oil pump, relief valve, sump, oil galleries, oil pressure indicator and oil filter. These components are associated with different faults that may cause the system to malfunction. Some of the faults include higher oil consumption, light glows and gauge showing low pressure reading (Giri, 2012). Giri further stated that these faults could be caused by worn bearings, ineffective oil control rings, weak relief valve spring, worn oil pump, clogged oil line, stuck relief valve and excessive strong valve spring.

From the foregoing, lubrication system is very paramount in automobile and as such students particularly the automobile students should have good knowledge of the lubricating system for them to effectively utilize automobile engines. However, Gawande, Navale, Nandgaonkar, Butala & Hunamalla (2012) pointed that there are cases whereby engines and machines are said to knock because of lubrication errors. This has caused loss to some people which include some automobile workshops in tertiary institutions. Hence, it will be worthwhile to carry out a study that will educate the automobile students, especially those who are new in the department the components, faults and causes of lubricating system. Therefore, this study will examine the components, faults and causes of faults associated with lubricating system.

*Purpose of the Study*

The study investigated diagnostic skills in lubricating system for effective fault detection in automobile engines among students in Rivers State tertiary institutions. Specifically, the study sought to:

1. Examined the components of lubricating system for effective utilization of automobile engines in Rivers State.
2. Investigate skills needed for diagnosis of faults associated with lubricating system for effective utilization of automobile engines in Rivers State.
3. Examine the causes of faults associated with lubricating system for effective utilization of automobile engines in Rivers State.

*Research Questions*

1. What are the components of lubricating system for effective utilization of automobile engines in Rivers State?
2. What are the causes of faults associated with lubricating system for effective fault detection of automobile engines among students in Rivers State Tertiary Institutions?
3 What are the skills needed for diagnosis of faults associated with lubricating system for effective automobile engines among students in Rivers State Tertiary Institution?

*Hypotheses*

The following hypotheses were tested at 05 level of significance:

1. There is no significant difference between the mean responses of Automobile lecturers and students on the components of lubricating system for effective utilization of automobile engines in Rivers State.
2. There is no significant difference between the mean responses of Automobile lecturers and students on the skills needed for diagnosis of faults associated with lubricating system for effective of automobile engines among students in Rivers State Tertiary Institution
3. There is no significant difference between the mean responses of Automobile lecturers and students on the causes of faults associated with lubricating system for effective utilization of automobile engines in Rivers State.

## II. METHODOLOGY

Descriptive survey design was used for this study. The population of the study comprised all the automobile lecturers and final students in Rivers State University, Ignatius Ajuru University of Education and Federal College of Education (Technical) Omoku. As at the time of this study, there was a total population of 27 automobile lecturers with 64 final year students in the three institutions. The total population (91 respondents) was used for the study due to the fact that the population was manageable. The instrument used for data collection was a self-made survey questionnaire titled “diagnostic skills in Lubricating System for Effective fault detection in Automobile Engines” (DSLEUAE). The instrument was structured in the pattern of 5-point Likert rating scale. The instrument was validated by two experts in the department of Vocational and Technology Education in Rivers State University, Port-Harcourt. The reliability of the instrument was established using test re-test method with

Pearson Product Moment Correlation. The instrument was administered to selected lecturers twice with an interval of two weeks. The data obtained from the two times of administering the instruments were used in computing the reliability of this study. The coefficient achieved was .82, Numally in Okwelle & Ayonmike (2014), recommended acceptable value of 0.7 for good reliability coefficient. Since the reliability coefficient obtained is above the value, the instrument was considered suitable for the study. Copies of the instruments were administered directly to the respondents by the researcher; all instruments administered were completely filled and returned by the respondents. Mean was used to answer the research questions, while Standard Deviation was used to ascertain the homogeneity of responses. Furthermore, t-test was used to test the hypotheses at .05 level of significance. Mean scores less than 3.00 were rejected while mean scores equal or greater than 3.00 were accepted. Also, calculated hypotheses value less than table value were accepted while calculated hypotheses greater than table values were rejected

## III. RESULTS AND DISCUSSION OF FINDINGS

What are the components of lubricating system for effective utilization of automobile engines in Rivers State?

Table 1: Mean Responses on the Components of Lubricating System

| | | Lecturers ($n_1$=27) | | | Students ($n_2$=64) | | |
|---|---|---|---|---|---|---|---|
| **S/N** | **Components of Lubricating System** | $\bar{X}_1$ | **SD** | **Decision** | $\bar{X}_2$ | **SD** | **Decision** |
| 1 | Oil sump | 4.59 | .97 | Agree | 4.50 | .85 | Agree |
| 2 | Oil pump | 4.78 | .42 | Agree | 4.53 | .85 | Agree |
| 3 | Oil filter | 4.26 | .94 | Agree | 4.47 | .99 | Agree |
| 4 | Oil galleries | 4.22 | 1.01 | Agree | 4.58 | .75 | Agree |
| 5 | Oil cooler | 4.37 | .84 | Agree | 4.56 | .83 | Agree |
| 6 | Piston cooling nozzles | 4.22 | 1.05 | Agree | 4.58 | .79 | Agree |
| 7 | Oil pressure indicator/light | 4.74 | .66 | Agree | 4.45 | 1.07 | Agree |
| 8 | Oil strainer | 4.70 | .67 | Agree | 4.47 | 1.05 | Agree |
| 9 | Oil pressure gauge | 4.70 | .67 | Agree | 4.48 | .98 | Agree |
| 10 | Oil level indicator | 4.59 | .84 | Agree | 4.55 | .91 | Agree |
| | **Total** | **4.52** | **.81** | **Agree** | **4.52** | **.91** | **Agree** |

Source: Field Survey, 2021

Result in Table 1 shows that both lecturers and students agreed that all the variables highlighted are the components of lubricating system for effective utilization of automobile engines in Rivers State. This is evident in the Grand Mean scores of 4.52 for lecturers and 4.52 for students, which are both greater than 3.00 which is the acceptable mean value. Also, the closeness in the Standard Deviation for both groups which is .81 and .91 shows homogeneity in the responses of both groups. This is in line with Bonnick and Newbold (2011) that opined that the main components in the lubricating system include the oil pump, relief valve, sump, oil galleries, oil pressure indicator and oil filter.

*Research Question 2*

What are the skills needed for diagnosis of faults associated with lubricating system for effective of automobile engines among students in Rivers State Tertiary Institution?

Table 2: Mean Responses on Faults Associated with Lubricating System

| | | Lecturers ($n_1$=27) | | | Students ($n_2$=64) | | |
|---|---|---|---|---|---|---|---|
| **S/N** | **Faults Associated with Lubricating System Diagnostic Skills needed** | $\bar{X}_1$ | **SD** | **Decision** | $\bar{X}_2$ | **SD** | **Decision** |
| 1 | Leakage detection skill | 3.63 | 1.57 | Agree | 4.03 | 1.39 | Agree |
| 2 | Oil wears out detection skills | 3.96 | 1.34 | Agree | 4.05 | 1.40 | Agree |
| 3 | High oil consumption detections skill | 3.74 | 1.38 | Agree | 4.06 | 1.40 | Agree |
| 4 | Oil gauge reads low detection skill | 3.74 | 1.38 | Agree | 4.11 | 1.36 | Agree |
| 5 | Indicator light glows detection skill | 3.85 | 1.35 | Agree | 4.13 | 1.34 | Agree |
| 6 | Abnormal engine noise detection skill | 3.66 | 1.49 | Agree | 4.16 | 1.32 | Agree |
| 7 | Gauge reads high detection skill | 3.93 | 1.41 | Agree | 3.98 | 1.52 | Agree |
| 8 | Oil filter swells detection skill | 3.85 | 1.46 | Agree | 4.00 | 1.51 | Agree |
| 9 | Low oil consumption detection skill | 3.89 | 1.40 | Agree | 4.05 | 1.43 | Agree |
| | **Total** | **3.81** | **1.42** | **Agree** | **4.06** | **1.41** | **Agree** |

Result in Table 2 shows that both lecturers and students agreed that all the variables highlighted are the skills needed for diagnosis of faults associated with lubricating system for effective utilization of automobile engines in Rivers State Tertiary Institutions. This is evident in the Grand Mean scores of 3.81 for lecturers and 4.06 for students, which are both greater than 3.00 which is the acceptable mean value. Also, the closeness in the Standard Deviation for both groups which is 1.42 and 1.41 shows homogeneity in the responses of both groups. This is in consonance with Giri (2012) that state that some of the faults include higher oil consumption, light glows and gauge showing low pressure reading

*Research Question 3*

What are the causes of faults associated with lubricating system for effective utilization of automobile engines in Rivers State?

Table 3: Mean Responses on Causes of Faults Associated with Lubricating System

| | | Lecturers ($n_1$=27) | | | Students ($n_2$=64) | | |
|---|---|---|---|---|---|---|---|
| S/N | Causes of Faults Associated with Lubricating System | $\bar{X}_1$ | SD | Decision | $\bar{X}_2$ | SD | Decision |
| 1 | Oil seal harden after a period of time | 3.93 | 1.33 | Agree | 3.97 | 1.37 | Agree |
| 2 | Worn bearings | 4.11 | 1.12 | Agree | 4.06 | 1.33 | Agree |
| 3 | Defective indicator | 3.89 | 1.19 | Agree | 3.94 | 1.45 | Agree |
| 4 | Over greasing | 3.89 | 1.19 | Agree | 4.05 | 1.34 | Agree |
| 5 | Leaking gaskets or seal | 4.00 | 1.14 | Agree | 4.03 | 1.38 | Agree |
| 6 | Worn cylinder | 3.78 | 1.25 | Agree | 4.05 | 1.36 | Agree |
| 7 | Worn piston rings | 4.07 | 1.21 | Agree | 4.11 | 1.43 | Agree |
| 8 | Clogged oil filter | 4.04 | 1.19 | Agree | 4.13 | 1.42 | Agree |
| 9 | Worn oil pump | 4.04 | 1.19 | Agree | 4.14 | 1.37 | Agree |
| | Total | 3.97 | 1.20 | Agree | 4.05 | 1.83 | Agree |

Result in Table 3 shows that both lecturers and students agreed that all the variables highlighted are the causes of faults associated with lubricating system for effective utilization of automobile engines in Rivers State. This is evident in the Grand Mean scores of 3.97 for lecturers and 4.05 for students, which are both greater than 3.00 which is the acceptable mean value. Also, the Standard Deviation for both groups which is 1.20 and 1.83 shows homogeneity in the responses of both groups. This is in conformity with Giri (2012) that opined that lubricating system faults could be caused by worn bearings, ineffective oil control rings, weak relief valve spring, worn oil pump, clogged oil line, stuck relief valve and excessive strong valve spring.

*Hypothesis 1*

There is no significant difference between the mean responses of Automobile lecturers and students on the components of lubricating system for effective utilization of automobile engines in Rivers State.

Table 4: z-test analysis on the Components of Lubricating System

| Category | N | $\bar{X}$ | SD | DF | z-cal | z-crit | Remarks |
|---|---|---|---|---|---|---|---|
| Lecturers | 27 | 4.52 | .81 | | | | |
| | | | | 89 | .00 | 1.98 | Not Significant |
| Students | 64 | 4.52 | .91 | | | | |

Table 4 shows that lecturers had mean and standard deviation scores of 4.52 and .81 respectively, while students had mean and standard deviation scores of 4.52 and .91 respectively. The z-cal value was .00, while the z-crit was 1.98 with df=89 at .05 level of significance for two tail test. This result shows that z-cal was less than z-crit which means that the null hypothesis was accepted. Thus, there was no significant difference between the mean responses of Automobile lecturers and students on the components of lubricating system for effective utilization of automobile engines in Rivers State.

*Hypothesis 2*

There is no significant difference between the mean responses of Automobile lecturers and students on the skills needed for diagnosis of faults associated with lubricating system for effective utilization of automobile engines in Rivers State tertiary institutions.

Table 5: z-test analysis on the Faults Associated with Lubricating System

| Category | N | $\bar{X}$ | SD | DF | z-cal | z-crit | Remarks |
|---|---|---|---|---|---|---|---|
| Lecturers | 27 | 3.81 | 1.42 | | | | |
| | | | | 89 | .77 | 1.98 | Not Significant |
| Students | 64 | 4.06 | 1.41 | | | | |

Table 5 shows that lecturers had mean and standard deviation scores of 3.81 and 1.42 respectively, while students had mean and standard deviation scores of 4.06 and 1.41 respectively. The z-cal value was .77, while the z-crit was 1.98 with df=89 at .05 level of significance for two tail test. This result shows that z-cal was less than z-crit which means that the null hypothesis was accepted. Thus, there was no significant difference between the mean responses of Automobile lecturers and students on the faults associated with lubricating system for effective utilization of automobile engines in Rivers State.

*Hypothesis 3*

There is no significant difference between the mean responses of Automobile lecturers and students on the causes of faults associated with lubricating system for effective utilization of automobile engines in Rivers State.

Table 6: z-test analysis on the Causes of Faults Associated with Lubricating System

| Category | N | $\bar{X}$ | SD | DF | z-cal | z-crit | Remarks |
|---|---|---|---|---|---|---|---|
| Lecturers | 27 | 3.97 | 1.20 | | | | |
| | | | | 89 | .25 | 1.98 | Not Significant |
| Students | 64 | 4.05 | 1.83 | | | | |

Table 6 shows that lecturers had mean and standard deviation scores of 3.97 and 1.20 respectively, while students had mean and standard deviation scores of 4.05 and 1.83 respectively. The z-cal value was .25, while the z-crit was 1.98 with df=89 at .05 level of significance for two tail test. This result shows that z-cal was less than z-crit which means that the null hypothesis was accepted. Thus, there was no significant difference between the mean responses of Automobile lecturers and students on the causes of faults associated with lubricating system for effective utilization of automobile engines in Rivers State.

## IV. CONCLUSIONS

The study deduced that lubricating system if one major component of automobile that contributes in keeping moving parts in motion. It also deduced that there are several components that make up lubricating system such as the oil pump, oil filter, oil sump, relief valve, oil galleries, oil indicator among others. These components could be associated with different faults such as leakages, high oil consumption, indicator light glows, abnormal engine noise; oil filters swells and others which could be cause by defective indicator, over greasing, leaking gaskets, worn cylinder, worn piston among others.

## V. RECOMMENDATIONS

The following recommendations were made:

1. Pictures of lubricating system components should be placed in the automobile workshop to make it possible for students to be familiar and conscious with lubrication.
2. Pictures of lubricating system faults should be placed conspicuously in the automobile workshop so that students can be able to note when an engine is becoming faulty due to lack of lubricant.
3. There should be proper orientation programme for students at automobile workshop so as to intimate students on the causes of faults associated with lubricating system so that students do not fall victim of defaulting the rules of lubrication.

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