

Critical Competencies Needs in Heavy Duty (Diesel) Engines Repair/Maintenance for Youth Employment and Nation Development in Lagos State

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Abstract

This paper investigated critical competencies needs in heavy duty (diesel) engines repair/maintenance for youth employment and nation development in Lagos State. Three research questions guided the study with survey research used to obtain responses from the target population of 69, comprising 24 lecturers/instructors of automobile technology in public colleges of education and technical colleges as well as using 45 informally trained heavy duty diesel engine mechanics, structured questionnaire was used as instrument. Validation of the instrument was carried out by experts; sample size was determined by the use of Yaro–Yamane formula. There were 79 items with sixty–nine copies of the instrument were administered while all these copies were retrieved. Analysis of the retrieved copies was done using mean and standard deviation to find out the needed competencies in the repairs and maintenance of heavy duty diesel engines for youth employment and national development. It was concluded that all the identified competencies on maintenance, repairs, tools and equipment in this study needed to be provided to conduct meaningful and result–oriented competency training in heavy duty diesel engine repairs and maintenance in Lagos State South- West, Nigeria.

Keywords: Diesel Engines, Youth Employment, National Development

Introduction

Commercial production of goods in organized industries leads to the various economic activities which boost the economy of a country. Derived from these productive ventures are youth employment, economic empowerment, reduction in criminal activities, and economic stability in commensurate proportion and general poverty reduction (Adebayo, 2013). One of the essential requirements for meaningful industrial activities is the availability of the right type of transportation (Badejo, 2005). Haulaging and movement of heavy goods including petroleum products, the Nigerian main source of economy are synonymous with the use of heavy goods vehicles (HGVs). Because of the rugged, heavy nature and space/distance needs of these transport services, petrol or

spark ignition engines are not suitable to be used as the prime-movers of the heavy goods vehicles. Diesel or compression ignition engines are used instead.

Most developed and developing economies are heavily investing in their youth in form of entrepreneurship training and skill development. In a country like Nigeria, where unemployment, under employment rates are high among nations of comparable statistics, it is only wise and pertinent to grasp the opportunities that are abound in the repair and services of diesel engines without which no meaningful economic planning, especially in distribution can thrive optimally (Dumbiri, 2011). Unfortunately, this has not been so.

According to Sowande and Olaitan, (2000), youths are young persons in their teens or early twenties. Youth unemployment is today recognized globally as one of the problems that could attain risky proportions, especially in developing economies in years to come, Famino and Okeke, (2009). The United Nations General Assembly Report (1995) puts the age range of youths at 15 – 24 years. This may slightly vary from culture to culture, from economy to economy, but one common factor remains that youths, according to UNGAR, (1995) have characteristics that can be exploited for skill acquisition. These may include, but not limited to less fear of failure, more energetic, more forthcoming for idea sharing and generation, healthier than adults, have sound memory and less prone to destructive tendencies of an adult. Consequently, upon this, UNESCO ,(2002) advocated for youth training in competency areas that are society needs especially in agriculture and technology as a way of minimizing unemployment, underemployment, poverty, crime rates, and youth restiveness (LASTVEB, 2010).

When there is shortage of skilled manpower required in a particular occupation and demand is prevalently seen to outweigh supply, the skill needed in this occupation is said to be critical, especially when an alternative supply is difficult to come by; this according to Mukora, (2008) will sooner than expected lead to sectional deficiency and economic imbalance.

The Highly Qualified Manpower Immigration Programmes (HQMIP) used by the British, Australian and Canadian Governments are the result of critical skill shortages which are mainly meant for artisans and tradesmen concessional immigration to these countries. Critical skills in the word of the National Board for Technical Education (NBTE), (2014) are those occupational areas that have great impact on the socio-economic wellbeing of the country and which have in the recent times, experienced very little training participation among the youths while current job holders are aging and becoming depreciated in strength, this resulting in sustained scarcity of such skills.

Sowande, (2002), defined competency as the needed skills, habits, attitudes, value – system and occupational appreciation by a workman to render his expected services to his clients or employers.

Characteristics and Peculiarities of Diesel Engine

Diesel engine as popularly called is a prime mover which derives its power from the burning of air and fuel; this is known as combustion according to Giri, (2011). It is technically called compression ignition (CI) engine because its combustion depends on the compression of charged air and fuel sprayed into an engine compartment called the combustion chamber with no use of electric spark, but only mechanical devices of injection pump and injection nozzles. The fuel used for the diesel engine is called Automotive Gas Oil (AGO) Hilier, (1985). It is made from crude oil just as gasoline or premium motor spirit (PMS). Diesel fuel used undergoes distillation and cracking process to obtain the end (fuel) product from the crude oil, Yadav, (2009).

The use of diesel engine cuts across the various industrial, civil engineering, transportation and power plants, industrial plants such as cranes, forklifts, hydraulic lifts, heavy duty generators, for civil engineering, graders, bulldozers, angledozas, motorized sweepers, jackhammer, tractors, concrete mixers, dumpers and others. In transportation, diesel engines are used for prime movers that pull the train coaches, ship engines, trucks, trailers, fuel tankers, mini trucks, buses, mini buses, cars and tricycles are installed with diesel fuel powered engines.

Diesel engines were not widely used till the tail end of 1960's as they are today, but the tide began to turn according to Horbye, (1987) when the Clean Air Act forced researchers to direct their attention to the diesel powered engines. The turns of tide increased during the fuel crises in the winter of 1973/74 during the Arab Oil embargo. Cars powered by diesel engines began to emerge in addition to heavy equipment and machinery use, Duffy, (2005), American companies such as caterpillar, Detroit – Diesel Allison, Cummins, Mack, international Harvesters Company Continental, J. I Case, John Deere, Allis – Chalmers and Waukesha were globally known for the production diesel engine and its related equipment, machines etc. just as Ingersoll-Rand, Cooper-industries, Studebaker – Worthington, Fairbanks-Morse, Dresser Industries and general Electric. Diesel fuel is a self-igniting, not using electric spark plug, but engines that run on it have the following characteristics, Dolan, (1983).

- a) They enjoy unrestricted inflow of oxygen
- b) Heavy component parts for a more rugged operations

- c) Use of mechanical equipment for fuel injection
- d) Noisy engine partly due to cracking of dirty fuel particles and movement of reciprocating parts
- e) Smelling, thick but less toxic exhaust fume than gasoline
- f) Engine attracts both internal and external deposits of dirt and carbon deposit requiring up to date attention (maintenance)
- g) Component parts are bigger and occupy more space
- h) Initial cost is higher
- i) Repair/maintenance requires more specialized training, especially with the use of Electronic Control Unit (ECU)

Because of its commercial and industrial importance, diesel engine is installed to prime-mover train coaches, ship, haulage vehicles called “heavy goods vehicles (HGVs)”, trucks, agricultural implements, mini – trucks, buses, fuel tankers, cars, high capacity generators.

As it is today, Nigeria’s electricity supply system is in a state of disarray. This has given room to indiscriminate ownership of various sizes, makes of electric generators which some elites have also used as status symbol, has also pushed prices of consumer products high due to operating cost. Some entrepreneurs and public/civil servants have also seen it as a conduit pipe since government business is also mainly carried out with the use of generators that operate on diesel fuel as main source of power supply.

Imported goods from Europe and America are loaded with heavy goods vehicles from the sea ports to various destinations. Fuel bearing tankers are also major mode of nationwide distribution of these essential liquids. These are some major sources of consumption of automobile gas oil popularly called diesel fuel used to power compression ignition (diesel) engines which also enjoys the use in few cars and tricycles.

Dolan, (1983) stated that the repair/maintenance requirements for diesel engines far outweighs those for gasoline installed engines, he therefore, posited that various specialization areas in diesel repairs/maintenance are:

- a. Injection equipment maintenance/repair
- b. Turbo/supercharger repairs
- c. Engine servicing

- d. Engine repairs
- e. Electrical repairs for starter motor, charging system and wire houses
- f. Electronic diagnosis/repair (for ECU installed engines)
- g. Radiator repairs (for water cooled engines)
- h. Machining (for crankshaft/camshaft, boring and extractor of broken bolts)

Compression Ignition (diesel) engines are used in a variety of ways globally.

The major areas are in the industrial machines, transport, power civil engines and agriculture. One of the operational characteristics of this important type of internal combustion (heat) engine is the emission of toxic smoke, mainly Nitrogen Oxide (NO_x) and Carbon Monoxide (CO), which have negative effects on animals and plants. This has been an addition to the issue of global warming as a result of depletion of the Ozone layer. Consequent upon these, there had been global campaign, John, (2002) for radical strategies for the reduction of toxic contents of exhaust fumes, as end products of diesel engine combustion, and other causal factors. Many strategies have been technologically cleansed for emission control in diesel engines, they include, but not limited to; use of catalytic converter to neutralize the toxic content in exhaust smoke, exhaust gas recirculation system, positive crankcase ventilation system, heated air – inlet system, air injection system and computerized emission control system. Ajao (2011). This has placed a lot of global importance on the legal and commercial necessity of prompt diesel engine repair and maintenance thereby, making available occupational opportunities.

This has placed a lot of global importance on repair and servicing of diesel engines, Nigerian inclusive in spite of the enormity of available specialized occupational areas in diesel engine technology, industrial and domestic importance, youths in Nigeria have shown very little interest in these money spinning job areas.

Statement of the Problem

Engaging in employment and employable skills by youths of this country has become a major problem as most of them are grossly involved in anti-social vices. The various introductions of Electronic Control Units (ECU), and On-Board Diagnostic System (OBD) into diesel engine operations has brought modernity which school leavers and graduates alike can explore in choosing an occupational specialization that will earn a living for them. Fortunately also, issues like heavy

parts, associated dirty characteristics of diesel engines have been partly addressed by the introduction of computer and information technology by size and weight reduction of parts.

Youths can take the advantage of the opportunities available in the maintenance and repairs of diesel engines not only to be occupied legally, but also to earn reasonable living, help to reduce youth restiveness and unemployment currently prevalent in the country today and contribute to the overall development of the society.

Purpose of the Study

The main purpose of this study is to highlight diesel engines repair/maintenance needed competencies in Lagos State. Specifically, this paper:

- a. find out required competencies needed by youths to repair diesel engines
- b. identify required skills and competencies needed by youths to carry out maintenance in diesel engine
- c. identify some basic tools/equipment required to repair/maintain diesel engines.

Research Questions

This study was guided by the following research questions

- (1) What competencies are required by youths to carry out maintenance works in diesel engines?
- (2) What competencies are required by youths to carryout repair works on diesel engines?
- (3) What competencies are required to identify the basic tools/equipment required to carry out maintenance/repair of diesel engines?

Methods

This study employed the descriptive survey research design. According to Uzoagulu (2011), survey research used to collect, organize and analyze data, describing them as they are in their natural setting with focus on people, their opinions, attitudes, motivation and behaviour.

The choice of this design was to allow for collection of requisite data for the study from automobile technology lecturer/instructors and the informally trained heavy duty mechanics in Lagos State on the critical competencies needed by youths for diesel engine repair and maintenance for their self or paid employment. Population sample for this study was drawn from lecturers/instructors of automobile technology in the two colleges of education and technical colleges as well as the

informally trained practicing automobile technology mechanics. This comprised 24 heavy duty automobile technology lecturers and 45 informally heavy duty mechanics. The selection of informally trained mechanics was done with stratified sampling because there would be bias if mechanics handling only one type of diesel engine were included. Consideration was given to five types/makes of diesel engines to ensure brand representativeness.

For this study, 78 question items on critical competencies in repair maintenance and tools/equipment were developed in a structured form. A, B and C. Section A contained a letter of introductions to the respondents, section B contained personal details of respondents while section C comprised the critical competencies needed by youths in Lagos State for the repair/maintenance of heavy duty diesel engines and the required tools/equipment. The question items were structured and each item of question was assigned a four – point likert scale of highly necessary, (4) necessary (3) seldomly necessary (2) and not necessary (1). A target population of 69 was taken from the 84 available respondents through the Yaro – Yamane formula ($n = N/I + N(e)^2$). The validation of the instrument was done by two lecturers from Adeniran Ogunsanya College of Education automobile technology department and one lecturer in the Faculty of Mechanical Engineering of Lagos State University, Epe Campus. All the copies of the questionnaire delivered to the respondents, 69 copies by two research assistants were retrieved, giving a 100% return rate.

Data collected for this study were collated, analysed and presented with the use of mean statistics to answer the research questions. Items that rated from 2.5 and above were accepted as needed, while any item that rated below 2.5 were rejected.

Results

Table 1: Competencies required By Youths to carryout Maintenance Works in Diesel Engines

S/No.	Items	X	SD	Remarks
1.	Check battery for current connection	3.52	0.89	Accepted
2.	Check the battery voltage	3.14	0.83	Accepted
3.	Stop fuel leakage from tank, filter or connection	3.54	0.93	Accepted
4.	Replace fuel filter as necessary	3.80	0.47	Accepted
5.	Manually determine oil change due time/date	3.03	0.68	Accepted
6.	Change the oil filter, engine oil and refill correctly	3.67	0.58	Accepted
7.	Bleed the fuel system to eliminate air lock	3.81	0.30	Accepted
8.	Replace battery terminal clips	3.56	0.69	Accepted
9.	Check radiator for leakage manually	3.62	0.73	Accepted
10.	Fill the radiator to required coolant level	3.68	0.74	Accepted
11.	Mix water and additive in correct ratio	3.34	0.82	Accepted

12.	Manually determine bad air cleaner	3.40	0.86	Accepted
13.	Replace air cleaner element with new one	3.83	0.38	Accepted
14.	Check drive belt tension	3.74	0.72	Accepted
15.	Replace bad drive belt	3.81	0.64	Accepted
16.	Manually determine non-working injectors (engine miss)	3.31	0.74	Accepted
17.	Know operative/inoperative fuel shut-off solenoid	3.32	0.81	Accepted
18.	Recognize dash – board fault code	3.30	0.43	Accepted
19.	Observe necessary safety precautions	3.26	0.78	Accepted
20.	Recognize right tools for jobs	3.55	0.79	Accepted
21.	Be able to replace fuel pipes, hoses and clips	3.19	0.94	Accepted
22.	Be able to eliminate noise resulting from drive belt/pulley friction	3.67	0.61	Accepted
23.	Use AVO meter for circuit test	2.89	1.15	Accepted
24.	Use scanner for further diagnosis	2.88	1.14	Accepted

All the 24 items of question as represented by the data were accepted as needed as critical competency items for youth employment in Lagos State in the repair and maintenance of heavy duty diesel engines. The mean values in this table range from 3.8 – 2.88. The standard deviation also revealed that they are within level of variability as shown in the range 0.30 – 1.15. This however, is still in agreement that all the skills itemized are needed for critical competency for youth training in heavy duty automobile mechanics in Lagos State.

Table 2: Competencies Required by Youths to Carry out repair Works on Diesel Engines

No.	Items	X	SD	Remarks
25.	Be able to check for battery voltage, current and resistance using AVO meter	3.33	0.83	Accepted
26.	Determine immediate and remote cause(s) of fuel leakages	3.54	0.87	Accepted
27.	Remove, check on – site some injector pump and nozzle components	3.26	1.03	Accepted
28.	Time injector pump and connect high pressure pipes correctly	3.17	1.1	Accepted
29.	Know how to use AVO Meter for detecting electrical faults	3.21	0.81	Accepted
30.	Be able to use engine scanner to detect ECM/engine related faults	3.01	1.41	Accepted
31.	Interpret fault diagnosed or codes for necessary repairs	2.94	0.99	Accepted
32.	Be able to dismantle and reassemble the engine parts	3.52	0.68	Accepted
33.	Recognize wears, broken parts, unwanted deposits etc.	3.20	1.29	Accepted
34.	Clean, grind and assemble valve mechanism.	3.14	1.11	Accepted
35.	Test and set the valve after assembly for possible leakage	3.72	0.48	Accepted
36.	Assemble the engine parts correctly	3.28	0.87	Accepted
37.	Time the crankshaft/camshaft gear correctly	3.48	0.83	Accepted
38.	Time the injector pump system correctly	3.69	0.95	Accepted

39.	Time the valves correctly	3.30	1.01	Accepted
40.	Mount the engine on applicable chassis	3.03	1.05	Accepted
41.	Start the engine, tune and test	3.18	0.66	Accepted
42.	Know how to mount injector pump on test bench	3.45	0.78	Accepted
43.	Know how to connect nozzle on tester	3.19	0.79	Accepted
44.	Be able to recognize bad fuel/oil	3.26	0.83	Accepted
45.	Use the right tools for the right job	3.79	0.41	Accepted
46.	Know and apply safety precautions appropriately	3.16	0.96	Accepted
47.	Ready to know more on the job	3.13	0.97	Accepted
48.	Carry test/repairs on charging system	3.03	1.01	Accepted
49.	Carryout test/repairs on starting system	3.36	0.84	Accepted
50.	Correct cooling system faults through repairs and replacement	3.17	1.11	Accepted
51.	Be aware of part-selling locations	3.51	0.69	Accepted

All the 27 items of questions in this table are accepted as being needed having satisfied the criteria for selection. The mean values range between 3.79 – 2.94 while there also occurred some level of within variability as shown by the standard deviation which ranged between 0.41 – 1.41. It can also be submitted that all the items met the selection criteria of 2.50 and above. This by interpretation means all the items are required for critical competency in heavy duty auto mechanic repairs and therefore, are accepted.

Table 3: Competencies Needed for Identification of the Basic Tools/Equipment required to carry out Maintenance/Repair of Diesel Engines

S/No.	Items	X	SD	Remarks
52.	Heavy duty open wrenches 6by 7mm – 42mm	3.59	0.75	Accepted
53.	Heavy duty close wrenches 6by 7mm – 42mm	3.44	0.91	Accepted
54.	Combination wrenches 6by 7mm – 42mm	3.51	0.72	Accepted
55.	Adjustable wrenches 27, 29, 12, 1	3.19	0.77	Accepted
56.	Allen (Key) wrenches 38, 11, 17, 2, 15	3.20	1.0	Accepted
57.	Socket wrenches 41, 10, 9, 9	3.20	1.0	Accepted
58.	Socket handle 41, 11, 7, 9	3.24	1.0	Accepted
59.	Ratchets for sockets 51, 3, 6, 9	3.39	1.10	Accepted
60.	Extension for sockets 47, 16, 5, 1	3.58	0.79	Accepted
61.	Screw drivers (various types)	3.74	0.61	Accepted
62.	Plier (set)	3.69	0.46	Accepted
63.	Hammers (set)	3.08	1.03	Accepted
64.	Chisels	3.05	0.98	Accepted
65.	Pinches	2.89	1.18	Accepted
66.	Files	3.36	0.78	Accepted
67.	Saw with blades	3.69	0.57	Accepted
68.	Vice (for holding/cutting)	3.30	0.87	Accepted
69.	Work bench	3.26	0.90	Accepted

70.	Jacks	3.60	0.89	Accepted
71.	Flaring tools	3.30	1.05	Accepted
72.	AVO meter	2.70	1.40	Accepted
73.	Scanning tools	3.23	1.98	Accepted
74.	Nozzle tester	3.78	0.57	Accepted
75.	Injector pump calibrating machine	3.50	0.65	Accepted
76.	Safety wears	3.30	0.86	Accepted
77.	Battery charger/jumper	3.13	0.92	Accepted
78.	Hydrometer	3.01	1.0	Accepted

All the 27 question items in this table were accepted based on their mean ratings ranging from 3.78–2.70. The standard deviations range between 0.57–1.98 which indicates that there was some variability in the agreement among the respondents on some items. All the items were however accepted as being necessary for tools/equipment needs in the repair/maintenance of heavy duty diesel engines in Lagos State.

Result and Discussions

Results of this study showed that the 24 competencies for the maintenance of heavy duty diesel engines were necessary and agreed with. 27 competencies for heavy duty diesel engines repair were also necessary and agreed with. Findings also revealed that the 27 competencies on recognition of tools/equipment needed to carryout maintenance and repair works on heavy duty diesel engines were also agreed with.

These findings corroborate the findings of a study carried out by Ogbuaya, Bakare and Adelaja (2010) in mechatronics skills required for integration into Electrical/Electronic Engineering programmes in Polytechnics for sustainable employment of graduates in contemporary Nigeria where the importance, economic benefits and industry necessities of the mechatronics skills were highlighted.

Also, supporting the findings of this study is the study carried out by Owodunni, Baba Doma, Simeon and Onatunde (2014) on maintenance of vocational and technical education workshop tools and equipment for effective strategy for educational growth and nation development. They concluded that the major problem faced by Nigerians was how to imbibe maintenance culture into our daily lives leading to wastage of government, institutional and personal properties which has led to closure of many companies/industries and also resulting in unprecedented rate of unemployment and its associated negative consequences.

Conclusion

As supported by the results of this study on the “critical competencies needed in heavy duty (diesel) engines repair/maintenance for youth employment and nation development in Lagos State, the competencies are needed to empower the youth, contribute to the nation’s economy, reduce restiveness resulting from unemployment and keep both environmental and industrial assets in healthy state.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Government at the three tiers should encourage youth entrepreneurial ventures to encourage youths’ interest in skill acquisition
2. Parents’ should be involved in seeking career guidance for their children to prevent occupational mismatch.
3. Private organizations should include youth skills acquisition programmes as part of their corporate social responsibility (CSR)
4. Trade Associations and Professional Bodies relating to Automobile Mechanic Works should participate in the process and efforts at training more youths in the identified important occupational areas.

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