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CORE SKILLS REQUIRED BY GRADUATES OF MOTOR VEHICLE MECHANIC WORK FOR MAINTAINING ANTI-LOCK BRAKING SYSTEM OF MODERN CARS IN LAGOS STATE

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ABSTRACT: *The study was carried out to determine the core skills required by graduates of motor vehicle mechanic work for maintaining anti-lock braking system of modern cars in Lagos State. A survey research design was employed for the study. The population for the study comprised 204 supervisors in 68 registered automobile maintenance industries in Lagos State. A structured questionnaire item was used for collecting data from the respondents. The instrument was validated by three experts. Cronbach alpha reliability method was employed to determine the internal consistency of the questionnaire items and 0.82 was obtained as reliability coefficient. Three research questions guided the study while three null hypotheses formulated were tested at 0.05 level of significance. Mean was used for answering research questions while t-test statistics was used to test the hypotheses of no significant difference at 0.05 levels of significance and 183 degree of freedom. It was found out that all the thirteen competencies in servicing, twenty four competencies in repairing anti-lock braking system and ten safety competencies identified were required by graduates of MVMW for maintaining anti-lock braking system. It was recommended that all the maintenance-abilities or competencies identified in the study should be used to retrain the graduates of MVMW in Lagos State. It was also recommended that experts and specialists in ABS maintenance should be employed to train the graduates of MVMW.*

KEYWORDS: Core Skills, Graduates, Motor Vehicle, Anti-Lock, Braking System, Modern Cars, Lagos State

INTRODUCTION

Technical colleges are secondary institutions where individuals are trained to acquire skills knowledge and attitudes required for either self or paid employment. Technical colleges offer varieties of technical and vocational trades to include motor vehicle mechanic work (MVMW). Olayinka (2009) explained that MVMW is designed to produce competent auto mechanics craftsmen for Nigeria technological and industrial development. The aim of motor vehicle mechanic work according to National Board for Technical Education (NBTE) (2004) is to give training and impart the necessary skills leading to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self-reliant. The graduates of MVMW are called auto mechanic craftsmen and are expected to acquire necessary skills to test, diagnose,

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service and completely repair any fault on the motor vehicle to the manufacturers' specification. Fadairo (2015) stated that the components of MVMW are arranged in modules for easy assimilation by learners. These components include engine maintenance, suspension, auto electricity and transmission reconditioning work, major engine repair works, service station mechanic, steering and braking system.

A brake is a mechanical device which inhibits motion, slowing or stopping a moving object or preventing its motion. A vehicle brake therefore is a device used to slow down a vehicle by converting its kinetic energy into heat energy. Various types of vehicle brakes include disc brakes, drum brakes, emergency brakes, air brakes, vacuum brake and anti lock braking system is the most recent one found in modern vehicles. Heibing (2011) defined anti-lock braking system (ABS) as an automobile safety system that allows the wheels on a motor vehicle to maintain tractive contact with the road surface according to driver inputs while braking, preventing the wheels from locking up (ceasing rotation) and avoiding uncontrolled skidding. Reynold (2006) stated that ABS is an automated system that uses the principles of threshold braking and cadence braking which were practiced by skillful drivers with previous generation braking systems. Anti lock braking system does this at a much faster rate and with better control than a driver could manage.

Typically ABS includes a central electronic control unit (ECU), four wheel speed sensors, and at least two hydraulic valves within the brake hydraulics (Gerald, 1994). The ECU constantly monitors the rotational speed of each wheel; if it detects a wheel rotating significantly slower than the others, a condition indicative of impending wheel lock, it actuates the valves to reduce hydraulic pressure to the brake at the affected wheel, thus reducing the braking force on that wheel; the wheel then turns faster. KI4CY (2003) explained that anti-lock braking systems use different schemes depending on the type of brakes in use. They can be differentiated by the number of channels: that is, how many valves that are individually controlled and the number of speed sensors. The schemes according to Heibing (2011) include four-channel, four-sensor ABS; three-channel, four-sensor ABS; three-channel, three-sensor ABS; two-channel, four sensor ABS and one-channel, one-sensor ABS. Anti-lock braking system in cars and most multi-purpose vehicles (MPV's) and pick-up trucks works on all four wheels. This promotes directional stability and allows steering while maximizing braking. ABS uses wheel speed sensors to determine if one or more wheels are trying to lock up during braking (Omkar Phatak, 2011). If a wheel tries to lock up, a series of hydraulic valves limit or reduce the braking on that wheel. This prevents skidding and allows driver to maintain steering control.

There are four main components of ABS: speed sensors, valves, a pump, and a controller (Sam, 2013). A speed sensor is used to determine the acceleration or deceleration of the wheel. These sensors use a magnet and a coil of wire to generate a signal. There is a valve also in the brake line of each brake controlled by the ABS. On some systems, the valve has three positions: In position one, the valve is open; pressure from the master cylinder is passed right through to the

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brake. In position two, the valve blocks the line, isolating that brake from the master cylinder. This prevents the pressure from rising further should the driver push the brake pedal harder. In position three, the valve releases some of the pressure from the brake. Club (2013) explained that the majority of problems with the valve system occur due to clogged valves. The pump in the ABS according to WiseGeek (2013) is used to restore the pressure to the hydraulic brakes after the valves have released it. The controller is an ECU type unit in the car which receives information from each individual wheel speed sensor, in turn if a wheel loses traction the signal is sent to the controller (Sam, 2013), the controller will then limit the brake force (EBD) and activate the ABS modulator which actuates the braking valves on and off.

Computer-controlled anti-lock braking system (ABS) is an important safety feature which is equipped on most new vehicles (Nice, 2000). When brakes are applied suddenly, ABS prevents the wheels from locking up and the tires from skidding. The system monitors the speed of each wheel and automatically pulses the brake pressure on and off rapidly on any wheels where skidding is detected (Club, 2013). This is beneficial for driving on wet and slippery roads. ABS works with the service brakes to decrease stopping distance and increase control and stability of the vehicle during hard braking but still create some maintenance problems for the owners of cars in Lagos State where modern cars are mostly used (Reynold, 2006). The ABS is a complex and sophisticated unit of motor vehicle and this makes it so difficult for road side mechanic to maintain. The modern car owners hardly locate efficient automobile craftsmen who can service and repair mal-functional ABS. The qualified automobile maintenance industries who can handle anti-lock braking systems are few in number compare to number of vehicles in Lagos State. The maintenance of ABS in these maintenance industries is very expensive and most of the car owners could not afford it. The road side automobile technicians who claim to be skilled in ABS maintenance mostly cause more damage to ABS in modern cars contracted to them. In order to provide solution to these problems and to expand the chance of employment of the graduates of MVMW, there is need to identify maintenance abilities in anti-lock braking systems. Maintenance abilities are the skills, knowledge, and attitudes or competencies required for effective servicing and repairing of anti locking braking system. Possession of maintenance abilities will enable motor vehicle mechanic work graduates to set up their workshops and maintain all kinds of ABS on various vehicles. These abilities or competencies therefore could be used to retrain the graduates because ABS is a recent technology and the curriculum of technical colleges does not specify the teaching of ABS to students. The major purpose of the study was determine the maintenance-abilities required by graduates of motor vehicle mechanic work for maintaining anti-lock braking system of modern cars in Lagos State. Specifically the study sought to achieve the following:

1. Identify the core skills required by graduates of MVMW for servicing anti-lock braking system
2. Identify the core skills required by graduates of MVMW for repairing anti-lock braking system

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3. Identify the Safety skills required by graduates of MVMW when maintaining anti-lock braking system

Research Questions

The following research questions guided the study:

1. What are the core skills required by graduates of MVMW for servicing anti-lock braking system?
2. What are the core skills required by graduates of MVMW for repairing anti-lock braking system?
3. What are the safety skills required by graduates of MVMW when maintaining anti-lock braking system?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

$H0_1$: There is no significant difference in the mean ratings of responses of the experienced and less experienced supervisors in automobile maintenance industries on core skills required by graduates of MVMW for servicing anti-lock braking system

$H0_2$: There is no significant difference in the mean ratings of responses of the experienced and less experienced supervisors in automobile maintenance industries on core skills required by graduates of MVMW for repairing anti-lock braking system

$H0_3$: There is no significant difference in the mean ratings of responses of the experienced and less experienced supervisors in automobile maintenance industries on safety skills required by graduates of MVMW when maintaining anti-lock braking system

METHOD

Survey research design was employed for this study. Osuala (2005) stated that survey research focuses on people and their opinions, attitudes, motivations and behavior. The survey research design is appropriate for this study because it aims at the determination of core skills required by graduates of motor vehicle mechanic work for maintaining anti-lock braking system of modern cars in Lagos State.

The study was carried out in Lagos State, which is an industrialized State and one of the States with highest number of modern car owners with high rate of unemployed graduates of motor vehicle mechanic work who migrate from other parts of the country. The population for the study was 204 experienced and less experienced supervisors in 68 Registered Automobile Maintenance Industries in Lagos State. There was no sampling because of the manageable size of the population. A structured questionnaire made up of 40 items was developed for collecting data in accordance with the research questions. The instrument was in three sections A-C. Section A of the instrument was for collecting data on competencies required by graduates of MVMW for servicing anti-lock braking system, section B was for collecting data on competencies required

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by graduates of MVMW for servicing anti-lock braking system while section C was prepared to collect data on safety competencies required by graduates of MVMW when maintaining anti-lock braking system. Each questionnaire item was assigned a five point response scale of highly required, required, undecided, slightly required and not required with values of 5, 4, 3, 2 and 1.

Three Lecturers from the Department of Science and Technology Education from the University of Lagos Akoka validated the instrument for the data collection. The internal consistency of the questionnaire items was determined using Cronbach alpha technique and a reliability coefficient of 0.82 was obtained. The 204 copies of the questionnaire were administered on respondents with the help of three research assistants who understand the terrain of study area. One hundred and eighty five out of 204 copies of the questionnaire administered were retrieved representing 90.68 percent return.

The data collected from the study were analyzed using mean for answering the research questions and the t-test was employed for testing the null hypotheses at probability level of 0.05 and 183 degree of freedom. An item with a mean rating of 3.50 or above was regarded as agree while any item with the mean rating below 3.50 was regarded as disagree. In taking decision on the hypotheses tested, the hypotheses of no significant difference was accepted where the P-value is greater than 0.05 levels and this indicated that there was no significant difference in the mean ratings of the responses of the two groups of respondents on that item. If the p-value is less than 0.05 levels, this indicated that the hypothesis of no significant difference in the mean ratings of the responses of the two groups of respondents was rejected for that item.

RESULTS

The results for the study were obtained from the research questions answered through data collected and analyzed.

Research Question 1

What are the core skills required by graduates of MVMW for servicing anti-lock braking system?

Hypotheses 1

There is no significant difference in the mean ratings of responses of the experienced and less experienced supervisors in automobile maintenance industries on core skills required by graduates of MVMW for servicing anti-lock braking system The data for answering research question one and the t- test analysis were presented in Table 1.

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Table 1: P-Values and Mean Ratings of the Responses of Supervisors on Core Skills required by Graduates of MVMW for Servicing Anti-lock Braking System

S/N	Competency Items	X	SD	P-value	Remarks, Ho
1	Identify the needed materials for servicing of ABS	3.72	0.73	0.33	Required, NS
2	Remove the wheels in order to clean the brakes	3.50	0.61	0.91	" "
3	Manually clean the brakes on the car	3.81	0.53	0.53	" "
4	Replace the brake fluid as often as recommended by your vehicle's owner's manual	3.72	0.62	0.59	" "
5	Recalibrate the speed sensors	3.57	0.78	0.56	" "
6	Top the brake fluid container as recommended by the manufacturers	3.62	0.63	0.62	" "
7	Change the brake lining if bad	3.61	0.70	0.72	" "
8	Check the positions of the brake sensors	3.56	0.82	0.78	" "
9	Check the lines of the ABS for leakages and functionality	3.69	0.69	0.71	" "
10	Identify the causes of ABS delay for rectification	3.68	0.80	0.44	" "
11	Check the service manual for the voltage and resistance values on various pins and sensors	3.55	0.78	0.43	" "
12	Consult the service manual for a chart of specific values of components	3.76	0.88	0.21	" "

Table 1 revealed that all the 12 core items had their mean values ranged from 3.50 to 3.81 which were above the cutoff point of 3.50. This indicated that all the 12 competencies were required by graduates of MVMW for servicing anti-lock braking system. Data presented in Table 1 also showed that all the core skills had their P-values ranged from 0.21 to 0.91 and were greater than 0.05 at 183 degree of freedom. This indicated that there was no significant difference in the mean ratings of responses of the experienced and less experienced supervisors in automobile maintenance industries on competencies required by graduates of MVMW for servicing anti-lock braking system. Therefore, the null hypothesis of no significant different was upheld for the 12 core skills required by graduates of MVMW for servicing anti-lock braking system.

Research Question 2

What are the core skills required by graduates of MVMW for repairing anti-lock braking system?

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Hypotheses 2

There is no significant difference in the mean ratings of responses of the experienced and less experienced supervisors in automobile maintenance industries on core skills required by graduates of MVMW for repairing anti-lock braking system. The data for answering research question one and the t- test analysis were presented in Table 2.

Table 2

P-Values and Mean Ratings of the Responses of Supervisors on Core Skills required by Graduates of MVMW for Repairing Anti-lock Braking System

S/N	Competency Items	X	SD	P-values	Remarks, Ho
1	Select appropriate tools and other materials for ABS repair	3.61	0.76	**0.23**	
2	Select a set of front and rear brakes pads and linings and 4 support jacks	3.56	0.81	**0.41**	
3	Pump the brakes 24 to 40 times while the key is in the off position to relieve the ABS system of any build up pressure	3.78	0.72	0.33	Require, NS
4	Use the floor jack to hoist the car	3.59	0.63	0.09	“ “
5	Place the support stands on the metal frames on both sides	3.60	0.87	0.12	“ “
6	Remove the tire and to reveal the rotor and caliper	3.74	0.66	0.59	“ “
7	Remove the caliper	3.59	0.82	0.54	“ “
8	Remove the old pads and replace them with the new pads	3.79	0.63	0.23	“ “
9	Check the master cylinder, brake lines and vacuum hoses	3.61	0.76	0.11	“ “
10	Ask assistant to pump the brake while watching	3.56	0.82	0.34	“ “
11	Make sure that the hoses do not expand when pressure is applied	3.69	0.69	0.20	“ “
12	Replace the damaged hose if happens	3.78	0.50	0.56	“ “
13	Replace the brake fluid	3.70	0.61	0.56	“ “
14	Pump the brakes to remove any air that may have entered the lines during your repair	3.96	0.45	0.67	“ “
15	Reattach the caliper	3.99	0.53	0.66	“ “
16	Put the tires back on the car	3.98	0.41	0.58	“ “
17	Lower the vehicle off of the supports	3.95	0.34	0.78	“ “
18	Pump the brakes several times to rebuild	3.78	0.38	0.91	“ “

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	pressure in the ABS system.					
19	Move the key to the on position to see if the ABS warning lights come on	3.97	0.62	0.74	"	"
20	Turn the car on and gently back up, applying the brakes lightly	3.91	0.61	0.56	"	"
21	Re-inspect the pad or lining if the brakes feel soft or spongy	3.89	0.52	0.74	"	"
22	Complete the work one wheel at a time	3.78	0.43	0.53	"	"
23	Remove any bad principal components of the ABS	3.63	0.83	0.22		
24	Spend the required time to make sure that it is set up completely before moving to another tire	3.78	0.67	0.11		

Table 2 revealed that all the 24 items had their mean values ranged from 3.56 to 3.98 which were above the cutoff point of 3.50. This indicated that all the 24 core skills were required by graduates of MVMW for repairing anti-lock braking system. Data presented in Table 2 also showed that all the competencies had their P-values ranged from 0.09 to 0.91 and were greater than 0.05 at 183 degree of freedom. This indicated that there was no significant difference in the mean ratings of responses of the experienced and less experienced supervisors in automobile maintenance industries on core skills required by graduates of MVMW for repairing anti-lock braking system. Therefore, the null hypothesis of no significant different was upheld for the 24 core skills required by graduates of MVMW for repairing anti-lock braking system.

Research Question 3

What are the safety skills required by graduates of MVMW when maintaining anti-lock braking system?

Hypotheses 3

There is no significant difference in the mean ratings of responses of the experienced and less experienced supervisors in automobile maintenance industries on safety skills required by graduates of MVMW when maintaining anti-lock braking system. The data for answering research question one and the t- test analysis were presented in Table 3.

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Table 3
Mean Ratings of the Responses of Supervisors on Safety Skills required by Graduates of MVMW when Maintaining Anti-lock Braking System

S/N	Core skills	X	SD	P-values	Remarks, Ho
1	Use relevant tools and equipment for the maintenance of ABS	3.78	0.75	0.23	**Require, NS**
2	Put on appropriate dresses such as overall and gloves	3.69	0.68	0.34	" "
3	Move the key to the on position to see if the ABS warning lights come on	3.81	0.68	0.33	" "
4	Turn the key to the off position when ready for operation	3.74	0.61	0.51	" "
5	Do not use a block of wood or some other item to support the weight of the vehicle	3.53	0.80	0.23	" "
6	Never crawl under a vehicle that has not been properly supported	3.72	0.69	0.54	" "
7	Take care not to get any dirt on the rotor, as it will affect the performance of the brakes	3.60	0.67	0.22	" "
8	Do not rush the job	3.56	0.77	0.78	" "
9	Use first class car jacks while maintaining ABS	3.69	0.69	0.37	" "
10	Apply recommended, brake shoes, brake lining, hoses and brake fluid	3.78	0.82	0.67	" "

Table 3 revealed that all the 10 core items had their mean values ranged from 3.53 to 3.81 which were above the cutoff point of 3.50. This indicated that all the 10 safety skills were required by graduates of MVMW when maintaining anti-lock braking system. Data presented in Table 3 also showed that all the skills had their P-values ranged from 0.22 to 0.78 and were greater than 0.05 at 183 degree of freedom. This indicated that there was no significant difference in the mean ratings of responses of the experienced and less experienced supervisors in automobile maintenance industries on the safety skills required by graduates of MVMW when maintaining anti-lock braking system. Therefore, the null hypothesis of no significant different was upheld for the 10 safety skills required by graduates of MVMW when maintaining anti-lock braking system.

DISCUSSION OF RESULTS

The results of the study reveal that the graduates of motor vehicle mechanics work required 13 core skills in servicing anti-lock braking system, 24 core skills in repairing anti-lock braking system and safety skills when maintaining anti-lock braking systems. These results agreed with

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the findings of Akinduro (2006) who conducted a study on electrical installation and maintenance work skills needed by technical college graduates to enhance their employment in Ondo state where he found out that graduates require various work skills in domestic and industrial installation, cable joint, battery charging and electrical machine winding for employment after graduation. The findings of the study were in agreement with the findings Dangana (2006) who conducted a study on technical skills improvement needs of auto electronic technicians for the maintenance of modern day automobile in Niger State and found out that 10 major skills in the electrical principles, 8 practical skills 11 skills in the knowledge of basic functions of tools and equipment, and 8 safety skills are needed by the auto-electronic technicians in order to improve their maintenance skills on modern day automobiles. The findings of this study also in line with findings of Bakare (2006) who carried out a study on safety practice skills needed by electrical electronic students of technical colleges in Ekiti State. The author found out that students of electrical/electronic needed safety practice skills in using hand tools, operating power tools, operating electric machines, working electrical workshops and using instructional manuals or guide. The findings of the authors cited above help to validate the findings of this study.

CONCLUSION

There is high time to train people for effective maintenance of ABS in modern cars in Lagos State. The modern car owners hardly locate efficient automobile craftsmen who can service and repair mal-functional ABS. The qualified automobile maintenance industries who can handle anti-lock braking systems are few in number compare to number of vehicles in Lagos State. It is in this direction that this study was conducted to identify maintenanceabilities required by graduates of MVMW for servicing and repairing faulty ABS for car owners.

RECOMMENDATION

1. All the competencies identified in this study should be used to organize training for the graduates of MVMW
2. Necessary facilities should be given to the graduates of motor vehicle mechanic work
3. Qualified training personnel should be invited to train the graduates of MVMW on effective maintenance of ABS

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