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Auto Electrical and Electronic Competencies Needed by Mechanical Work Students for Vehicle Diagnosis and Maintenance in Technical Colleges of Enugu State

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Abstract

The general purpose of this study was to ivestiage the auto electrical and electronic competencies needed by mechanical work students for vehicle diagnosis and maintenance in Technical Colleges in Enugu State. Specifically, it determined important competencies for diagnosing vehicles, important competencies for maintaining vehicles, those important competencies for diagnosing and maintaining vehicles already possessed by mechanical work students, and vehicle diagnosing and maintenance competencies needed by mechanical work students in Technical Collegies. Two hypotheses guided the research. The study adopted a survey research design and was carried out in Enugu State.Population was 56 comprising of motor vehicle mechanical work teachers and instructors. A 5-point Likert Scale questionnaire was used for data collection. Data were analysed using mean and t-test for testing the hypotheses at 0.05 level of significance. Findings include, among others,23 important competences for diagnosis and 21 for maintenance of motor vehicle.These include ability to: perform a scan tester diagnosis on vehcles ways($\bar{X}$= 3.58), define terms associated with OBD II diagnosis ($\bar{X}$= 3.54), connect diadnostic tools to the identified ports ($\bar{X}$= 3.83), repair lighting system ($\bar{X}$= 3.57), and others. Enhance their efforts at equipping the students with the important competencies they need on;y 13 (29.5%) out of the two sets of competencies put together. The students need to acquire 16 (69.57%) and 15(71.43) of the important vehicle diagnosis and maintenance respectively. It was recommended among other things that, mechanical work teachers and instructors should engage in in-service training to acquire the skills.

Keywords: Competencies, Diagnosis, Maintenance, Vehicles, Mechanical Students, Technicalcolleges.

Introduction

The quest for technical college graduates who can transform the knowledge and skills learnt successfully in industries or companies is in high demand. Unfortunately, these graduates are yet to meet up with the required competences necessary for employment. Competency is skill one possesses that enables one to perform a task. Competence is the combination of practical and theoretical knowledge, cognitive skills, behavior and values used to improve performance. Maaleki, (2018), stated that competency could be measured and developed through

training. Stevenson, (2012) noted that competency development process comprises of the mental reflection process as well as the physical action process. These processes are obtainable in various trades in technical colleges.

Technical colleges are training grounds for individuals to acquire technical awareness and useful skills necessary for mastering a particular trade. Ede, et al (2010) describe technical colleges as educational institutions established with the aim of training students to acquire appropriate vocational skills, knowledge, attitudes, that enable them develop their intellectual and economic capabilities, and become self-reliant.The colleges equip individual with practical skills, knowledge and attitude required of craftsmen and technicians at sub-professional level (Okoro 2006). Technical colleges are mainly established for the training of students to acquire practical skills, knowledge and attitudes essential for employment in various trades (Eze and Okafor, 2012a). The various trade areas offered in technical colleges include; furniture making, painting, electrical and electronics repairs and installations, welding and fabrication, plumbing, woodworking, carpentry, and motor vehicle mechanics etc.

Technical College graduates are suppose to gain employment after graduation but the rate the graduates are being unemployed is becoming more critical in Nigeria. This may be attributed to the inability of graduates to possess adequate knowledge and practical skills needed for a gainful employment in different companies and industries across the country (UNIDO, 2020). This is as a result of high rate of technological advancements in companies and industries both in Nigeria and the world at large. Shittu (2014) observed that the products of technical institutions, including technical colleges, are found to possess fewer competencies in their different occupational trades.

Oluka (2016) explained that motor vehicle mechanic work (MVMW) being one of the trade is designed to produce competent auto mechanics craftsmen who acquires necessary skills to test, diagnose, service and completely repair any fault on motor vehicle to the manufacturers' specification (Oluka, 2016). The aim of motor vehicle mechanic work according to National Board for Technical Education (NBTE) (2011), 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. Fadairo (2016) & Roner (2014) stated that the components of MVMW are arranged in modules for easy assimilation to learners of technical colleges. These components include engine maintenance, suspension, auto electrical electronic and transmission work, major engine repair works, service station mechanic, steering and braking system and others. Vehicle electrical and electronic systems being one of the component are crucial and complicated systems in automobile. It is complicated in the sense that it comprises of many sub units such as the charging, ignition, starting systems that work together as component parts of the electrical and electronic system. National Board Technical Education (NBTE) (2011)

&Federal Republic of Nigeria (FRN), (2013), stated that students upon graduation should be able to understand the principles of electricity generation as applicable to automobiles,

Innovation in automobile manufacturing industries has led to the production of vehicles with new technological designs, techniques, methods and ideas in the development and operation of automobile. These set of vehicles normally come with interface or data link connector called On-Board Diagnosis (OBD). OBD is an automotive term referring to a vehicle's self-diagnostic and reporting ability (Donal, 2009 &Medashe, 2020). OBD being a technology that is embedded within an engine control unit (ECU) is connected to this kind of vehicle for onward diagnosis and maintenance of faults and provides easy operation of vehicle. (Igwe et al, 2017).

Wyman (2007) and Dickson & Adu-Agyem, (2018). noted that this technological innovation in automobile have brought comfort, safety, smoothness of operation, ease of maintenance, strength, durability, cleaner and better economic services, among others. In the view of Giri (2010) and Ezeama, et al, (2016), this aspect of innovation in automobile makes the vehicle to perform better in safety and economical than those other vehicles. As these innovations in the automobile industry have equipped vehicles with many good things, these vehicles at one time or the other develop either electrical or electronic faults, which will be repaired or maintained by MVMW students upon graduation (Goldwasser, 2012 & Soni 2013). Unfortunately, MVMW students may not diagnose and maintain vehicles effectively due to lack of adequate training and practices as concern these vehicles. Some of the MVMW students are not even aware of so called auto diagnostic tools, and this has made them incompetent in their field upon graduation there by rendering most of the MVMW unemployed after graduation especially in Enugu state (Mustaphaet al, 2016 & Ogunmilade, 2017). It is also observed by Shittu (2014) that the products of technical colleges are found to possess fewer competencies for employment in industries. This unfortunately is not in line with the major goal of Technical College which is to produce efficient and relevant craftsmen and women that will enhance industrial development in the area of maintenance, goods production and general services (United Nations Industrial Development Organization) (UNIDO,2020). It is against this back ground that this study was constituted to ascertain the auto electrical and electronic competencies needed by mechanical work students for vehicle diagnosis and maintenance in technical Colleges in Enugu State.

Purpose of the Study

This study is designed to investigateauto electrical and electronic competencies needed by mechanical work students for vehicle diagnosis and maintenance in technical Colleges in Enugu State. Specifically, the study determine the:

1. important competences for diagnosis of vehicles for students in Technical Colleges of Enugu.
2. important competences for maintenance of vehicles for students in Technical Colleges of Enugu.

3. those important competences for diagnosis and maintenance of vehicles already possessed by the students in Technical Colleges of Enugu.
4. vehicle diagnosis and maintenance competences needed by students in Technical Colleges of Enugu.

Research Questions

The following research questions were formulated to guide the study.

1. What are the important competences for diagnosis of vehicles for students in Technical Colleges of Enugu?
2. What are the important competences for maintenance of vehicles for students in Technical Colleges of Enugu?
3. What are those important competences for diagnosis and maintenance of vehicles already possessed by students in Technical Colleges of Enugu?
4. What are the vehicle diagnosis and maintenance competences needed by students in Technical Colleges of Enugu?

Hypotheses

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

There are no significant differences between the mean responses of MVMW teachers and instructors onimportant competences for:

HO_1: diagnosis of vehicles for students in Technical Colleges of Enugu.

HO_2: maintenance of vehicles for students in Technical Colleges of Enugu.

Methodology

***Design of the study*:** The study adopted a descriptive survey research design.

Area of the study: The study was carried out in the two accredited technical colleges in Enugu State, Nigeria. There are Government Technical College Enugu and Government Technical College in Nsukka.

Population for the study: The population of this study was made up of 56 motor vehicle mechanical work (MVMW) teachers and instructors of the technical colleges in Enugu State. The entire population involved in the study.There was no sampling since the population is of manageable size.

***Instrument for data collection*:** A structured questionnaire with 5-points Likert scale was used for data collection. The instrument was validated by three experts. Cronbach Alpha reliability technique was used to determine the internal consistency of the items of the instrument, which yielded an overall reliability coefficient of 0.81.

***Data collection methods*:** The data was collected by the researchers and two research assistants.

***Data analysis techniques*:** The data collected were analysed using mean to answer the research questions Questionnaire. Items with the mean of 3.50 and above were considered as Important, Possessed and Needed while questionnaire items less than 3.50 was considered Not important, Not Possessed and not needed. The two null hypotheses were tested using T-test at 0.05 level of significance.

Findings

Table 1: Mean Responses, Standard Deviation and t-test of MVMW Teachers and Instructors on the Important Competences for Diagnosis ofVehicles for Students in Technical Colleges of Enugu.

S/N	Important competences for diagnosis	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}g$	t	Rem
	Ability to:							
1	define terms associated with OBD II diagnostics	3.59	0.77	3.50	0.76	3.54	0.67	Agree
2	explain the basic format of OBD II diagnostic trouble codes (DTCs)	3.51	0.50	3.54	0.55	3.52	0.93	Agree
3	identify the cause of illuminated malfunction indicator Light (MIL)	3.53	0.62	3.63	0.61	3.58	0.77	Agree
4	conduct preliminary checks on an OBD II system	3.69	0.46	3.59	0.47	3.64	0.62	Agree
5	perform a scan tester diagnosis on vehicles	3.53	0.62	3.63	0.61	3.58	0.73	Agree
6	select the right diagnostic tool to diagnose faults in present day vehicles	3.69	0.46	3.59	0.47	3.64	0.40	Agree
7	enter car details, selecting codes and the letters the codes are represented with	3.52	0.55	3.52	0.56	3.52	0.42	Agree
8	use OBD II scanners to identify anti-lock braking system faults	3.56	0.52	3.55	0.53	3.55	0.78	Agree
9	use OBD II scanners to identify automatic transmission solenoid faults	3.53	0.62	3.63	0.61	3.58	0.95	Agree
10	diagnose electronic power steering (EPS) OBD II scan tool, and repairing it	3.69	0.46	3.59	0.47	3.64	0.73	Agree
11	use OBD II scan tool to diagnose and repair electronic fuel injection system	3.53	0.62	3.63	0.61	3.58	0.88	Agree
12	repair exhaust gas recirculation system	3.69	0.46	3.59	0.47	3.64	0.66	Agree
13	diagnose oxygen sensor to check for malfunction and ensure clean emission of vehicle	3.52	0.55	3.52	0.56	3.52	0.97	Agree
14	test of circuit for excessive resistance	3.56	0.52	3.55	0.53	3.55	1.00	Agree
15	check amperes with digital multi meter (DMM)	3.55	0.55	3.80	0.50	3.67	0.09	Agree
16	check battery condition with appropriate tools and diagnose faults	3.61	0.46	3.63	0.49	3.62	0.56	Agree
17	diagnose current flow or bad connection of instrument panels gauges with OBD II scanners and multi-meter	3.53	0.62	3.63	0.61	3.58	0.69	Agree
18	detect faulty instrument panels sensors and replace it	3.69	0.46	3.59	0.47	3.64	0.55	Agree
19	identify on-board diagnostic ports in vehicles	3.80	0.90	3.60	0.94	3.70	0.98	Agree
20	perform voltmeter test with appropriate tool and diagnose faults in voltages	3.59	0.77	3.50	0.76	3.54	0.99	Agree

Table 1 continued

21	check the functionality of fuses, relays, switches of power windows	3.51	0.50	3.54	0.55	3.52	1.02	Agree
22	inspect switches, fuse and wiring circuit and repair faulty parts	3.53	0.62	3.63	0.61	3.58	0.74	Agree
23	fault trace in light circuit	3.69	0.46	3.59	0.47	3.64	0.68	Agree

$\overline{X}_1$= Mean of teachers; SD_1 = Standard deviation of teachers; $\overline{X}_2$= Mean of instructors; SD_2 = Standard deviation of instructors; $\overline{X}_g$ = Grand mean; t=t-test; REM =Remark.

Table 1 show that respondents agreed to items 1-23 as the important electrical and electronic competences for diagnosis of vehicles for mechanical students in Technical Colleges of Enugu. From the table, it can be deduced that all the items were accepted based on the fact that their grand mean values are above 3.50, which is the cut-off point for the study. Also, the standard deviations (SD) of the items are within the range of 0.46 to 0.94, which indicates that the mean values of the respondents were not far from one another in their responses. The table also presents the t-test between the mean responses of teachers and instructors on the important electrical and electronic competences for diagnosis of vehicle by MVMW students. The t-calculated value of the items ranges from 0.09 to 1.02 which is higher than 0.05 with the degree of freedom of 47. This implies that the null hypothesis of no significant difference between the mean scores of MVMW teachers and instructors on the important electrical and electronic competences for diagnosis of vehicle for students is therefore accepted.

Table 2: Mean Responses of MVMW Teachers and Instructors on the Important Competences for Maintenance of Vehicles for Students in Technical Colleges of Enugu.

S/N	Important competences for maintenance	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}g$	t	Rem
	Ability to:							
1	rectify petrol pump circuit fuel pump	3.53	0.62	3.63	0.61	3.58	0.69	Agree
2	rectify warning light circuit	3.69	0.46	3.59	0.47	3.64	0.99	Agree
3	use scan tool software and hardware to read data from an OBD II compliant car	3.80	0.80	3.60	0.94	3.70	0.46	Agree
4	analyze real-time scan data and to use a symptom chart a problem	3.53	0.51	3.58	0.50	3.55	1.00	Agree
5	maintain safe work environment	3.55	0.55	3.80	0.50	3.67	1.03	Agree
6	perform Load Test to check the load performance of battery	3.61	0.48	3.63	0.49	3.62	0.78	Agree
7	connect diagnostic tools to the identified ports	3.57	0.60	4.07	0.65	3.82	0.83	Agree
8	assemble starter motor components properly	3.59	0.64	3.90	0.67	3.74	0.94	Agree
9	perform Hydrometer Test to check gravity of battery and diagnose faults	3.50	0.73	3.70	0.74	3.60	0.91	Agree

Table 2 continued

10	rectify windscreen wiper circuit	3.59	0.77	3.50	0.76	3.54	0.67	Agree
11	check Ignition System sensors with OBD II scanners and replacing faulty sensors	3.51	0.50	3.54	0.55	3.52	0.68	Agree
12	check solenoid relay and fuses with appropriate tools	3.50	0.64	3.55	0.56	3.55	0.92	Agree
13	repair lighting system	3.55	0.61	3.60	0.54	3.57	0.83	Agree
14	repair heating ventilation and air conditioning of vehicles	3.50	0.57	3.66	0.52	3.58	1.00	Agree
15	diagnose and carry out inspection of blower motor	3.52	0.55	3.52	0.56	3.52	0.98	Agree
16	use the Air Conditioning vacuum pressure gauge	3.56	0.52	3.55	0.53	3.55	0.67	Agree
17	repair vehicles sun roof	3.55	0.50	3.66	0.52	3.60	0.76	Agree
18	repair Security and Immobilizer of vehicles	3.50	0.52	3.64	0.58	3.57	0.82	Agree
19	perform test using voltmeter	3.52	0.53	3.55	0.56	3.53	0.79	Agree
20	check the extent of traction control using traction control tester	3.53	0.64	3.50	0.65	3.51	0.98	Agree
21	perform operations using electronic stability tester	3.55	0.51	3.52	0.50	3.53	0.90	Agree

$\bar{X}_1$= Mean of teachers; SD_1 = Standard deviation of teachers; $\bar{X}_2$= Mean of instructors; SD_2 = Standard deviation of Agree instructors; $\bar{X}_g$ = Grand mean; t=t-test; REM =Remark.

Table 2 shows that respondents agreed to items 1-21 as the important electrical and electronic competences for maintenance of vehicles for students in Technical Colleges of Enugu. From the table, it can be realized that all the items were accepted based on the fact that their grand mean values are above 3.50, which is the cut-off point for the study. Also, the standard deviations (SD) of the items are within the range of 0.48 to 0.90, which indicates that the mean values of the respondents were not far from one another in their responses. The table also presented the t-test between the mean responses of teachers and instructors on the important electrical and electronic competences for maintenance of vehicle by MVMW students. The t-calculated value of the items ranges from 0.46 to 1.00 which is higher than 0.05 with the degree of freedom of 47. This implies that the null hypothesis of no significant difference between the mean scores of MVMW teachers and instructors on the important electrical and electronic competences for maintenance of vehicle for students is therefore accepted.

Table 3: Mean Responses of MVMW Teachers and Instructors on Those Important Competences for Diagnosis and Maintenance of Vehicles Possessed by Students in Technical Colleges of Enugu.

S/N	Important competences for diagnosis and maintenance of vehicles already possessed	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}g$	Rem
	Ability to:						
1	use the air conditioning vacuum pressure gauge	3.52	0.53	3.55	0.56	3.53	P
2	repair heating ventilation and air conditioning of vehicles	3.53	0.64	3.50	0.65	3.51	P
3	diagnose of common electronic ignition system faults	3.55	0.51	3.52	0.50	3.53	P
4	test of circuit for excessive resistance	3.52	0.50	3.55	0.56	3.53	P
5	define terms associated with OBD II diagnostics	3.52	0.53	3.55	0.56	3.53	P
6	carry out inspection of operation of cooling fan, water temperature gauges, and replace faulty parts	3.52	0.55	3.52	0.56	3.52	P
7	repair lighting system	3.56	0.52	3.55	0.53	3.55	P
8	maintain safe work environment	3.55	0.55	3.52	0.50	3.53	P
9	identify on-board diagnostic ports in vehicles	3.53	0.64	3.50	0.65	3.51	P
10	perform test using voltmeter	3.55	0.51	3.52	0.50	3.53	P
11	check the functionality of fuses, relays, switches of power windows	3.80	0.90	3.60	0.94	3.70	P
12	conduct preliminary checks on an OBD II system	3.53	0.51	3.58	0.50	3.55	P
13	faults tracing in light circuit	3.52	0.50	3.55	0.56	3.53	P

$\bar{X}_1$= Mean of teachers; SD_1 = Standard deviation of teachers; $\bar{X}_2$= Mean of instructors; SD_2 = Standard deviation of instructors; $\bar{X}_g$ = Grand mean; REM =Remark, P =Possessed.

Table 3 shows that respondents agreed to 13 items listed as the only possessed competences out of the total of 44 important electrical and electronic competences for diagnosis and maintenance of vehicle. It indicates that MVMW students do not possess enough electrical and electronic competences for diagnosing and maintenance of vehicle.This is indicated from the table, that all the 13 items had their grand mean values above 3.50, which is the cut-off point for the study. Also, the standard deviations (SD) of the items are within the range of 0.50 to 0.90, which indicates that the mean values of the respondents were not far from one another in their responses.

Table 4: Mean Responses of MVMW Teachers and Instructors on the Vehicle Diagnosis Competences Needed by Students in Technical Colleges of Enugu.

S/N	Vehiclecompetences for diagnosis needed	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}g$	Rem
	Ability to:						
1	check amperes with Digital Multi Meter (DMM)	3.86	0.98	3.86	0.98	3.86	N
2	Perform voltmeter test with appropriate tool and diagnose faults in voltages	4.41	0.50	4.41	0.50	4.41	N
3	Perform Load Test to check the load performance of battery	4.04	0.76	4.04	0.76	4.04	N
4	Perform Hydrometer Test to check gravity of battery and diagnose faults	4.49	0.51	4.49	0.51	4.49	N
5	Check Ignition System sensors with OBD II scanners and replacing faulty sensors	4.37	0.49	4.37	0.49	4.37	N
6	Check solenoid relay and fuses with appropriate tools	4.47	0.50	4.47	0.50	4.47	N
7	Check battery condition with appropriate tools and diagnose faults	3.94	0.83	3.94	0.83	3.94	N
8	Diagnose current flow or bad connection of instrument panels gauges.	4.41	0.64	4.41	0.64	4.41	N
9	Detect faulty instrument panels sensors and replace it	4.31	0.62	4.31	0.62	4.31	N
10	Connect diagnostic tools to the identified ports	4.39	0.49	4.39	0.49	4.39	N
11	Diagnose and carry out inspection of blower motor	4.39	0.49	4.39	0.49	4.39	N
12	Use OBD II scanners to identify anti-lock braking system faults	4.39	0.61	4.39	0.61	4.39	N
13	Use OBD II scanners to identify automatic transmission solenoid faults	4.47	0.50	4.47	0.50	4.47	N
14	Diagnose Electronic Power Steering (EPS) OBD II scan tool, and repairing it	4.39	0.61	4.39	0.61	4.39	N
15	Use OBD II scan tool to diagnose and repair Electronic Fuel Injection System	4.35	0.48	4.35	0.48	4.35	N
16	Diagnose oxygen sensor with an OBD II scanner	4.12	0.97	4.12	0.97	4.12	N

$\bar{X}_1$= Mean of teachers; SD_1 = Standard deviation of teachers; $\bar{X}_2$= Mean of instructors; SD_2 = Standard deviation of instructors; $\bar{X}_g$ = Grand mean; REM =Remark, N= Needed

Table 4 shows that respondents agreed to all the items listed as the electrical and electronic competences needed by MVMW students to diagnose vehicles. From the table, it can be deduced that all the 16 items were accepted based on the fact that their mean values are above 3.50, which is the cut-off point for the study. Also, the standard deviations (SD) of the items are within the range of 0.48 to 0.98, which indicates that the mean values of the respondents were not far from one another in their responses.

Table 5: Mean Responses of MVMW Teachers and Instructors on the Vehicle Maintenance Competences Needed by Students in Technical Colleges of Enugu.

S/N	Vehiclecompetences for maintenance needed	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}g$	Rem
	Ability to:						
1	Rectify petrol pump circuit/electrical fuel pump	4.47	0.50	4.47	0.50	4.47	Ne
2	Explain the basic format of OBD II Diagnostic Trouble Codes (DTCs)	4.39	0.57	4.39	0.57	4.39	Ne
3	Identify the cause of illuminated Malfunction Indicator Light (MIL)	4.47	0.54	4.47	0.54	4.47	Ne
4	Rectify of warning light circuit	4.18	0.60	4.18	0.60	4.18	Ne
5	Perform a scan tester diagnosis	4.39	0.53	4.39	0.53	4.39	Ne
6	Select the right diagnostic tool to diagnose faults in vehicles	3.84	0.72	3.84	0.72	3.84	Ne
7	Enter car details, selecting codes and the letters the codes are represented with	4.37	0.49	4.37	0.49	4.37	Ne
8	Use scan tool software and hardware to read data from an OBD II compliant car	4.43	0.50	4.43	0.50	4.43	Ne
9	Analyze real-time scan data and to use a symptom chart	4.47	0.50	4.47	0.50	4.47	Ne
10	Carry out inspection of operation of cooling fan, water temperature gauges.	4.43	0.61	4.43	0.61	4.43	Ne
11	Connect diagnostic tools to the identified ports	4.39	0.49	4.39	0.49	4.39	Ne
12	Assemble starter motor components properly	4.39	0.53	4.39	0.53	4.39	Ne
13	Repair vehicles sun roof	4.53	0.54	4.53	0.54	4.53	Ne
14	Check the extent of traction control using traction control tester	4.37	0.60	4.37	0.60	4.37	Ne
15	Perform operations using electronic stability tester	4.00	0.61	4.10	0.62	4.07	Ne

$\bar{X}_1$= Mean of teachers; SD_1 = Standard deviation of teachers; $\bar{X}_2$= Mean of instructors; SD_2 = Standard deviation of instructors; $\bar{X}_g$ = Grand mean; REM =Remark, Ne= Needed

Table 5 shows that respondents agreed to all the items listed as the electrical and electronic competences needed by MVMW students to maintenance of vehicles. From the table, it can be deduced that all the 15 items were accepted based on the fact that their mean values are above 3.50, which is the cut-off point for the study. Also, the standard deviations (SD) of the items are within the range of 0.46 to 0.98, which indicates that the mean values of the respondents were not far from one another in their responses.

Discussion of Findings

The findings of this study relating to research question one revealed that all the 23 items listed as the important electrical and electronic competences for diagnosis vehicle for MVMW students were accepted by teachers and instructors of MVMW. The findings

were in agreement with the opinion of Giri (2010), who pointed out that there are necessary competences for diagnostic that suit the vehicle faults, which include basic electrical diagnosis, engine systems analysers, On-Board-Diagnoses among others. Simolowo & Oyekola, (2017) also added that vehicle diagnosis and repair can be categorized into two; namely those that can diagnose the entire faults in a car, and those with specific task. It is therefore necessary that MVMW students should possess the important competences. Eze, & Okorafor, (2012a) is also of the view that the major goals of Technical College education include production of efficient and relevant craftsmen and women that will enhance industrial development in the area of maintenance, production of goods and general services.

The findings of this study relating to research question two revealed that all the 21 items listed as the important electrical and electronic competences for maintenance of vehicle for MVMW students were all accepted by teachers and instructors of MVMW. The findings were in agreement with the opinion of Eze, & Okorafor, (2012a) that indicated that the major goal of Technical College education is to produce efficient and relevant craftsmen and women that will enhance industrial development in the area of maintenance, goods production and general services. Olayinka (2009) also explained that MVMW is designed to produce competent auto mechanics craftsmen for Nigeria technological and industrial development. It is therefore necessary that MVMW students should possess the important competences for maintaining vehicles.

The findings of this study relating to research question three revealed that MVMW teachers and instructors agreed to a few items as the only electrical and electronic diagnosis and maintenance competencies possessed by MVMW students. This indicates that MVMW students do not possess enough competence for diagnosis and maintenance of vehicle. This is in agreement with the findings of Muhammad, Azlan Bin & Audu (2014), who asserted that MVMW students possessed little or no competencies in diagnosis of common battery faults and their symptoms; conducting initial battery charge and recharge; breaking down acid to obtain the correct electrolyte and others. It is also observed by Shittu (2014) that the products of technical colleges are found to possess fewer competencies for employment in industries.

The findings of this research work relating to research question four which is presented in table four and five revealed showed that all the 16 items relating to the vehicle diagnosis competencies and the 15 items relating to the vehicle maintenance competences needed by MVMW students were all accepted by MVMW teachers and instructors as needed. These findings agree with Shahbaz (2014), who asserted that MVMW students need competences in demonstrating communication skills, maintaining safe work environment, repairing electrical systems of vehicle and others.UNIDO, (2020) attributed the unemployment of technical college students to the inability of graduates to possess adequate knowledge and practical skills needed for a gainful employment in

different companies and industries across the country (UNIDO, 2020). Wyman (2007), also noted that this technological innovation in competence development in automobile brings about comfort, safety, smoothness of operation, ease of maintenance, strength, durability and others in automobile.

Conclusion

Technical colleges in Nigeria are established to expose individuals to skills in various trades or occupations most especially in MVMW. The main emphasis of the program is the acquisition of skills for employment after graduation. Unfortunately, MVMW students in technical colleges in Enugu State do not possess enough competencies in handling vehicle diagnosis and maintenances. This has posed a serious challenge to them upon graduation. To put an end to this situation, this study has identify the important competences possessed and needed by MVMW students for diagnosing and maintaining vehicles thus the technical college students should be equipped with the identified competences for adequate diagnosing and maintenance of vehicle for employment and self reliance after graduation.

Recommendations

1. Teachers and instructors of should enhance their efforts at equipping the students with the important competencies.
2. School should embrace the identified vehicles electrical and electronic systems diagnosis and maintenance competencies needed by MVMW students and integrated into the curriculum of the technical college program.

References

Ede, E.O. Miller I.O. and Bakare, J. A (2010). Work skill improvement needs of graduates of Technical colleges in machines shop practice for demand driven employment in southwest zone of contemporary Nigeria. A paper presented at the annual conference of Nigeria Vocational Association at Faculty of Education University of Nigeria, Nsukka.

Eze, T. I., & Okorafor, A. O. (2012a). Trends in technical, vocational education and training (TVET) for improving the Nigerian workforce. *EbonyiTechology and Vocational Education Journal.*

Dickson, A., Emad, K. H., Adu-Agyem, J. (2018). Theoretical and conceptual framework: Mandatory ingredients of a quality research. *International Journal of Scientific Research, 4*(176), 2277-2287.

Donal, O.C. (2009). *An embedded automotive monitoring device*. Ireland: Cork Institute of Technology.

Ezeama, A. O., Obe, P.I., & Ede, E.O.(2016). Assessment of capacity building needs among motor vehicle mechanics trainers for the use of auto scan tools. *Nigerian Journal of Technology(NIJOTECH), 35*(4), 805-813.

Fadairo, O.O. (2016). Development of entrepreneurship skill training modules in motor vehicle mechanic work for enhancing employability of technical college graduates in Lagos state, Nigeria. *Journal of Innovative Practice in Vocational Technical Education (JIPVTE), 1*(1), 014-015.

Federal Republic of Nigeria. (2013). *National policy on education.* Lagos: NERDC Press.

Giri, N. K. (2010). *Automobile technology*. Delhi: Khanna Publishers.

Goldwasser, S. M. (2012). *Troubleshooting and repair of consumers' electronic equipment*. Retrieved from www.repair.org/sam/tshoot.htm

Igwe, N., Ikenwa, M.O., &Jwasshaka, S.K. (2017). Competences in on board diagnostic actuators for effective teaching of petrol engine maintenance in technical colleges in Nigeria. *Journal of Computer Engineering (IOSR-JCE), 19*(2), 11-15.

Maaleki, A. (2018). *The arzesh competency model: Appraisal and development manager's competency model*. Amirkabir University of Technology: Lambert Academic Publishing.

Medashe, M. (2020). Specifications and analysis of digitalized diagnostics of automobiles: A case study of on board diagnostic (OBDII). *International Journal of Engineering Research& Technology (IJERT), 9*(1), 411-421.

Muhammad, M.I., Azlanbin, A.L., & Audu, R. (2014). An appraisal of technical skills possessed by technical college auto-mechanics graduates in Nigeria. *Industrial Engineering letters. www.iiste.org, 4*(8), 2224-2234.

Mustapha, A., Idris, A. M., Kutiriko, A.A., &Ewugi, A. M. (2016). Competencies needed by automobile technology teachers towards the development of ICT for teaching – learning purposes. *International Conference on Information and Communication Technology and its Applications (ICTA 2016) Federal University of Technology, Mina, Nigeria. November 28-30, 2016*.

National Board for Technical Education (NBTE). (2011). *The development of national vocational qualifications framework (NVQF) for Nigeria*. A Report of the National Steering Committee. NBTE Press.

Nworgu, B. G. (2015). *Educational research: Basic issues & methodology (3rd ed.)*. Nsukka, Nigeria: University Trust Publishers.

Ogunmilade, O.J.(2017). Core skills required by graduates of motor vehicle mechanic work for maintaining anti-lock braking system of modern cars in Lagos state. *International Journal of Vocational and Technical Education Research, 3*(1), 1-11.

Okorie, J.U. (2000). *Developing Nigeria's work force*. Calabar: Environs Publishers.

Okoro, O. M. (2006). *Principles and methods in vocational technical education in Nigeria*. Nsukka: University Trust Publishers.

Oluka, S.E. (2016). Entrepreneurial competencies needed by electrical/ electronic graduates of technology education for self employment in Enugu state. *British Journal of Education, 4*(8), 105-115.

Roner, K. C. (2014). *Improving automotive troubleshooting skills.* All graduate planB and other reports 402. https:// digitalcommons.usu.edu/gradereports /402

Shahbaz, A. (2014). *National competency standards for auto electricians*. Pakistan: Islamabad.

Shittu, A. R. (2014). *Mechatronics skills needed by mechanical craft practice teachers in technical colleges in Lagos state*. An M.Ed Thesis University of Nigeria, Nsukka.

Simolowo, O. E., &Oyekola, A. J. (2017). Impact analysis on the application of contemporary methods of maintenance in the Nigerian automotive industry. *Advances in Research, 11*(6), 1-11.

Soni, P. K. (2013). Total productive maintenance–an implementation experience. *International Journal of Research in Engineering and Technology, 2*(5), 263-267.

Stevenson, J. (2012). Working knowledge. *Journal of Vocational Education and Training, 52*(3), 503-519.

United Nations Industrial Development Organization (UNIDO). (2020). *UNIDO competency model*. Retrieved from https://www.unido.org/userfiles/tim minsk/UNIDO-Competency Model-Part1.pdf

Wyman, O. (2007). *2015 car innovation: A comprehensive study on innovation in the automobile industry*. New York: Oliver Wyman Automotive.