

## ASSESSMENT OF WORKSHOP FACILITIES IN MECHANICAL ENGINEERING TRADE PROGRAMMES IN NORTH CENTRAL STATES, NIGERIA

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### Abstract

*This study was designed to assess workshop facilities in mechanical engineering trade programme in technical colleges in North Central States, Nigeria. Two research questions guided the study. A descriptive survey research design was adopted for the study. The study was conducted in all the technical colleges in North Central State, Nigeria. A total population of 113 respondents which consist of 45 Motor Vehicle Mechanics Work (MVMW) teachers, 25 Welding and Fabrication Craft Practice (WFCP) teachers, 28 MVMW instructors and 15 WFCP instructors were used for the study. A 77 items structured questionnaire designed by the researchers and validated by one expert from Industrial Technology Education Department, Federal University of Technology Minna and two experts from Department of Vocational and Technology Education Abubakar Tafawa Balewa University, Bauchi, Nigeria was used for data collection for the study. Cronbach alpha statistics was used to determine the internal consistency of the instrument and the overall reliability coefficient of the instrument yielded 0.74. The data collected for the study was analysed using mean and percentage. Mean and percentage were used for answering the research questions. The findings of the study revealed that that basic motor vehicle mechanics hand tools are adequate, whereas, general servicing, reconditioning tools and other equipment are not adequate, the result of the instrument machinery shows that all the items are not adequate. Based on the findings the following recommendations were made among others that government at both federal and state level should provide adequate funds for the purchase of workshop tools, equipment and other machineries especially in mechanical engineering related programmes, the industries should also assist technical colleges in the provision of workshop tools, equipment and other machineries*

**Keywords:** Mechanical Engineering Trades, Technical Colleges, Technical Vocational Education and Training, Workshop Facilities

### Introduction

Technical Vocational Education and Training (TVET) could be termed as that aspect of education which provides the recipients with the basic knowledge and practical skills necessary for entry into the world of work as employees or as self-employed. The TVET is defined as that type of education which fits the individual for gainful employment in recognized career as semi-skilled workers or technicians or sub-professionals. This type of education can be offered in technical colleges. Technical colleges in Nigeria are considered as the major vocational institutions. They provide education and training which is geared towards the preparation of students for employment into different vocations. Technical colleges in Nigeria are set up to produce craftsmen at the craft (secondary) level and master craftsmen at the advance craft (post- secondary) level. According to the National Board for Technical Education (NBTE, 2001) technical college programmes are classified into related trades, which include: electrical/electronic trades, construction trades, miscellaneous trades, business trades and mechanical engineering trades.

Mechanical Engineering Trades (METs) is a common term that is being utilized in defining trades that are having complete bearing with metal welding/forming and or servicing/repairs of machines or machine related equipment and appliances. The occupations in this category comprises of agricultural implement and equipment mechanic work, motor vehicle mechanics work, auto body repair and spray painting, auto electrical work, auto body building, auto parts merchandising, air-conditioning and refrigeration mechanics work, mechanical engineering craft practice, welding and fabrication engineering craft practice, foundry craft practice, instruments mechanics work and marine engineering craft (Peter, Abiodun & Jonathan, 2010). Mechanical engineering trade comprises of training and learning on how to productively employ the use of strong scientific and mathematical base for the design of safe, dependable, environmentally sound, and cost efficient techniques. At

advanced degree levels, Mechanical Engineers carry out major research required to gain skills and knowledge in the engineering sciences (Dublin Institute of Technology, 2008). These skills and knowledge cannot be acquired without the provision of adequate workshop facilities in schools. Workshop facilities in the context of this study can be generally defined as tools, equipment and other machineries that are used for practical exercises in Motor Vehicle Mechanic Works (MVMW) and Welding and Fabrication Craft Practice (WFCP)12a workshops. Workshops facilities are part of the teaching facilities which include all tools, equipment and other material resources that are used to support the delivery of quality education.

Campbell (1997) classified workshop facilities into three categories, consumables, non-consumables and physical plant (buildings and equipment). Other relevant facilities in the school environment include text books, laboratory equipment, computer machines, seating facilities, supply of electricity, technical and vocational facilities such as tools and equipment which are all paramount to the provision of qualitative education (Omotayo, Ihebereme, & Maduewesi, 2008). They further noted that these important education facilities are either not available or inadequate or in a state of disrepair in most institutions below the tertiary level. Ehiemetalor (2001) on his part laments on the poor maintenance culture of existing facilities. Other issues that may exacerbate the problem include poor management which often manifests in poor maintenance culture, inadequate funding and lack of policy or poor record keeping and monitoring of existing facilities.

The current state of workshop facilities in most institution is very worrisome. According to Umar and Ma'aji, (2010) the current state of facilities in Technical Vocational Education and Training institutions is poor, there is no scheduled measures of maintenance of the broken down machines, equipment or resources for acquiring new ones, there is no much concern on the part of authorities, teachers and students for the deplorable state of the facilities in the schools. This pathetic situation needs to be addressed in order to realize the objectives of TVET as specified in the National Policy of Education (FRN, 2013). According to the policy, the goals of TVET; shall be (i) to provide trained manpower in the applied sciences, technology and business particularly at the craft (equivalent of high schools), advanced craft and technical levels; (ii) provide the technical knowledge and vocational skills necessary for agricultural, commercial and economic development; (iii) to give training and impart the necessary skills to individuals who shall be self-reliant economically.

Afeti (2007) stated that, the quality of training in TVET schools is too poor with much emphasis on academics and certification at the expense of skills acquisition and proficiency. Lack of adequate instructor training, out-dated training equipment, and inadequate teaching aids are a number of the problems that lead to the reduction of the effectiveness of TVET programmes. High quality skills training in technical colleges needs qualified teachers and workshop instructors, adequate and right workshop equipment, machineries, tools, adequate provision of instructional resources, and practice by the students.

Teachers and workshop instructors are very paramount for effective teaching and learning in technical colleges especially in mechanical engineering trade programmes. The teachers teaching mechanical engineering trade programmes at technical college level must have the right skills to impart to the learners in order for them to acquire the right skills for gainful employment, the workshop instructors must also impart practical skills to the learners in the technical college workshop (Audu, Musta'amal, Kamin, Saud & Inti 2014). Both the teachers and workshop instructors should equip the mechanical engineering trade students with necessary theoretical knowledge and practical skills that will enable them secure paid employment, be able to set up their workshops and be self-employed and even employ others. In order to be able to achieve these goals TVET programmes must adequately provided with workshop facilities.

However, TVET programmes have not been effectively provided with the required workshop facilities over the years, despite the number of good TVET policies. It is probable that these policies were either not properly implemented or not implemented at all.

### **Statement of the Problem**

A well designed, equipped and established workshop is expected to equip students with the necessary practical skills after graduation from the technical colleges. Students that are trained in adequately equipped MVMW and WFCP workshops are supposed to after graduation to be able to carry out maintenance, diagnose faults in automobile vehicles and fabricate parts. Most technical college graduates do not possess good quality skills that will enable them carry out maintenance, repairs and fabrication of parts in the workshop (Ohwojero & Ede, 2013). The poor skills demonstrated by the

students after graduation could be caused by poor tools and equipment, lack of adequacy and availability of the tools and equipment in the workshops. Therefore, the study is designed to assess workshop facilities in mechanical engineering trade programmes in technical colleges in North Central States, Nigeria in order to ascertain the state of affairs and meet the goals of TVET as stipulated in the National Policy of Education (FRN, 2013).

#### **Aim and Objectives of the Study**

The main aim of this study is to Assess Workshop Facilities in Mechanical Engineering Trade Programme in technical colleges in North Central States, Nigeria. Specifically the study is designed to determine the adequacy of workshop tools and equipment in:

1. Motor Vehicle Mechanics Works (MVMW) programme for effective skills acquisition
2. Welding and Fabrication Craft Practice (WFCP) programme for effective skills acquisition

#### **Research Questions**

1. How adequate are workshop tools and equipment in MVMW works programme for effective skills acquisition?
2. How adequate are workshop tools and equipment in WFCP programme for effective skills acquisition?

#### **Methodology**

Descriptive survey research design was adopted for this study. Nworgu (1991) described descriptive survey research as one in which a group of people or items are studied by collecting and analyzing data from only few people or items that are considered to be representative of the entire group. The study was carried out in the technical colleges in North Central Nigeria which is made up of Niger, Kogi, Kwara, Benue, Plateau, Nassarawa States and Federal Capital Territory (FCT) Abuja. The targeted population for this study consisted of 113 respondents comprising of 45 MVMW teachers, 25 WFCP teachers, 28 MVMW workshop instructors and 15 WFCP workshop instructors. The choice of the population was based on the fact that they are familiar with the workshop tools and equipment in mechanical engineering trade programme and therefore are in a very good position to give authentic information on the workshop tools and equipment in mechanical engineering trade programme in the technical colleges.

The instrument for data collection for this study was structured questionnaire which was developed by the researchers. The instrument was face validated by one expert from National Board for Technical Education and two experts from the Federal Science and Technical College Kafanchan Kaduna State. To determine the reliability of the instrument, it was pilot-tested on 15 respondents from Government Technical College Malali Kaduna, Kaduna State. The reliability coefficient of the instrument used for the data collection for the study was 0.74 using Cronbach alpha statistics. The questionnaire was administered by the researchers with the help of 17 research assistants. The data collected for the study was analysed using mean, and percentage for answering the research questions using Statistical Package for Social Sciences version 23.0.

A four (4) point rating scale was used to determine the level of adequacy of the workshop tools and equipment in mechanical engineering trade programme. The decision rule was based on theory of true class limits of numbers with numerical values ranging between 3.01 – 4.00= Very Adequate ; 2.01 – 3.00 = Adequate ; 1.01 – 2.00= Not Adequate; 0.01 – 1.00 = Not Available respectively. Therefore, the mean responses of the respondents were interpreted based on the true class limits of numbers as highlighted

## Results

**1 Research Question One:** How adequate are workshop tools and equipment in MVMW workshop for effective skills acquisition?

**Table 1:** Mean and Percentage Responses of the Respondents on the Adequacy of Workshop Tools and Equipment in MVMW Workshop for Effective Skills Acquisition.

Item No	Item	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_A$	%	Remarks
<b>Motor Vehicle Mechanics Tools</b>						
1	Set of pin punches parallel and taper	2.48	2.50	2.49	62.25	Adequate
2	Hollow punches of various sizes	2.37	2.67	2.52	63.00	Adequate
3	Plug spanners	2.00	3.01	2.51	62.75	Adequate
4	6-32mm socket spanner sets with ratchet, brace, extension, U.J and handles	2.26	2.17	2.22	55.50	Adequate
5	14.6-32mm open and flat spanners	2.41	2.92	2.67	66.75	Adequate
6	15. 6-32mm ring spanners	2.34	2.25	2.30	57.50	Adequate
7	Sets of Allen keys	2.35	2.67	2.51	62.75	Adequate
8	Feeler gauges	2.30	2.60	2.45	61.25	Adequate
9	Drill bits	2.44	2.25	2.35	58.75	Adequate
10	Set of stock and dies - UNC, UNF and metric sets	2.39	2.67	2.53	63.25	Adequate
11	Taps and wrenches - UNC, UNF and metric	2.52	2.75	2.64	66.00	Adequate
12	Thread file	2.33	2.67	2.50	62.50	Adequate
13	Dial indicator (gauge) with magnetic stand	2.35	2.75	2.55	63.75	Adequate
<b>General Servicing &amp; Reconditioning Tools &amp; Equipment</b>						
14	Diesel phasing & calibration machine	1.44	1.50	1.47	36.75	Not Adequate
15	Electrical test bench	1.00	0.93	0.97	24.25	Not Available
16	Cylinder boring machine with accessories and assorted tools	1.63	1.67	1.65	41.25	Not Adequate
17	Honing machine with accessories and assorted cutters	1.80	1.92	1.86	46.50	Not Adequate
18	Bottle jack (hydraulic) light vehicle type	1.70	1.92	1.81	45.25	Not Adequate
19	Dynamometer	1.48	1.75	1.62	40.50	Not Adequate
20	Motor scope (engine analyzer)	1.00	0.78	0.89	22.25	Not Available
21	Timing light	1.24	1.75	1.50	37.50	Not Adequate
22	Tachometer	1.13	1.08	1.11	27.75	Not Adequate
23	Compression gauge	1.96	1.25	1.61	40.25	Not Adequate
24	Torque wrench pre-set type (metric graduation)	1.46	2.11	1.79	44.75	Not Adequate
25	Torque wrench dial type (metric)	1.44	1.50	1.47	36.75	Not Adequate
26	Carburetors service kit	1.52	2.14	1.83	45.75	Not Adequate
27	Piston ring compressor	1.76	2.22	1.99	49.75	Not Adequate
28	Exhaust gas analyzer	1.85	2.00	1.93	48.25	Not Adequate

## Notation

$\bar{X}_1$  = Mean of MVMW teachers,  $\bar{X}_2$  = Mean of MVMW instructors,  $\bar{X}_A$  = Average Mean of the Respondents, % = Percentage

The information contained in Table 1 present the result of the respondents' opinion on the adequacy of workshop tools and equipment in MVMW workshop for effective skills acquisition in technical colleges in North Central States of Nigeria. The respondents are of the view that all the motor vehicle mechanics basic hand tools are adequate with average mean value ranging between 2.67(66.75%) to 2.22 (55.50%). However, the general response of the respondents with respect to the general servicing, reconditioning tools and equipment indicate that most of the tools and equipment are not adequate with average mean value ranging between 1.99(49.75%) to 1.47(36.75%). Only two items

Electrical test bench and Motor scope (engine analyzer) were not available with average mean value 0.97(24.25%) to 0.89(22.25%). From the Table the results revealed that basic motor vehicle mechanics hand tools are adequate, whereas, general servicing, reconditioning tools and other equipment are not adequate.

**Research Question Two:** How adequate are workshop tools and equipment in WFCP workshop for effective skills acquisition?

**Table 2:** Mean and Percentage Responses of the Respondents on the Adequacy of Workshop Tools and Equipment in WFCP Workshop for Effective Skills Acquisition.

**Table 2:** Mean and Percentage Responses of the Respondents on the Adequacy of Workshop Tools and Equipment in WFCP Workshop for Effective Skills Acquisition

Item No	Item	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_A$	%	Remarks
<b>Welding &amp; Fabrication Tools &amp; Equipment</b>						
1	Straight snips	2.21	2.30	2.26	56.50	Adequate
2	Bench shears	2.29	2.90	2.60	65.00	Adequate
3	Power saw cutting machine 10mm	1.71	2.30	2.01	50.25	Adequate
4	Cropping machine	2.21	1.70	1.96	49.00	Not Adequate
5	Straight edge	2.36	2.20	2.28	57.00	Adequate
6	Trammels dividers (set)	1.75	2.00	1.88	47.00	Not Adequate
7	Smith open forge	1.61	2.50	2.06	51.50	Adequate
8	Electrode holders	2.07	2.00	2.04	51.00	Adequate
9	Electrode drying oven	1.43	1.80	1.62	40.50	Not Adequate
10	Heavy duty grinding machine	1.06	0.89	0.98	24.50	Not Available
11	Oxy-acetylene cylinder trolley	1.46	2.50	1.98	49.50	Not Adequate
12	Oxy-acetylene regulators	1.70	2.20	1.95	48.75	Not Adequate
13	Oxy-acetylene welding kits	2.00	1.90	1.95	48.75	Not Adequate
14	Blowpipes (low and high pressure)	2.21	1.70	1.96	49.00	Not Adequate
15	Anvil	1.36	2.40	1.88	47.00	Not Adequate
16	Swage block	1.61	2.00	1.81	45.25	Not Adequate
17	Chipping hammers	1.32	2.30	1.81	45.25	Not Adequate
18	Sledge Hammer	2.46	2.50	2.48	62.00	Adequate
19	G. Clamps – assorted	2.25	2.80	2.53	63.25	Adequate
20	Self-grip pliers – assorted	2.29	2.10	2.20	55.00	Adequate
21	Pipe bender	1.64	2.50	2.07	51.75	Adequate
22	Pipe cutter	1.50	2.00	1.75	43.75	Not Adequate
23	Flaring kit	1.68	1.90	1.79	44.75	Not Adequate
24	Swaging tools	2.54	2.70	2.62	65.50	Adequate
25	Stock and dies	2.89	2.60	2.75	68.75	Adequate
26	Stilton wrench	2.68	2.10	2.39	59.75	Adequate
27	Pop-rivet gun-tornado guns	1.64	2.00	1.82	45.50	Not Adequate
28	Metal shears	2.57	2.30	2.44	61.00	Adequate
29	Power brush	1.36	1.80	1.58	39.50	Not Adequate
30	AF Spanners	2.04	2.50	2.27	56.75	Adequate
31	Pipe wrench	1.89	2.20	2.05	51.25	Adequate
32	Hollow punches	2.25	2.20	2.23	55.75	Adequate
33	Electronic leak detector	1.43	2.10	1.77	44.25	Not Adequate
34	Halide leak detector	1.32	2.30	1.81	45.25	Not Adequate
<b>Instrument Machinery &amp; Equipment</b>						
35	Dial thermometer	1.64	1.40	1.52	38.00	Not Adequate
36	Wall thermometer	1.54	1.60	1.57	39.25	Not Adequate
37	Graduated charging units	1.39	1.20	1.30	32.50	Not Adequate
38	Capacitor analyser	1.14	1.40	1.27	31.75	Not Adequate
39	Hand expansion valve	1.86	1.30	1.58	39.50	Not Adequate
40	Check valve	1.43	1.20	1.32	33.00	Not Adequate

41	Solenoid valve	1.54	1.50	1.52	38.00	Not Adequate
42	Non-return valves	1.39	1.40	1.40	35.00	Not Adequate
43	Pressure regulating valve	1.57	1.50	1.54	38.50	Not Adequate
44	Thermostats	1.50	1.20	1.35	33.75	Not Adequate
45	Low pressure controls	1.50	1.60	1.55	38.75	Not Adequate
46	High pressure controls	1.68	1.50	1.59	39.75	Not Adequate
47	Liquid valve	1.54	1.60	1.57	39.25	Not Adequate
48	Filter drier (flange type)	1.46	1.70	1.58	39.50	Not Adequate
49	Oxy/acetylene, welding set.	2.01	1.50	1.78	44.50	Not Adequate

The result presented in Table 2 revealed the respondents' opinion on the adequacy of workshop tools and equipment in WFCP workshop for effective skills acquisition in the technical colleges. The respondents are of the opinion that most of the basic hand tools in WFCP as listed in the Table are adequate with average mean ranging from 2.75(68.00%) to 2.01(50.25%). With respect to the equipment in WFCP the result shows that majority of the equipment are not adequate with average mean value from 1.98(49.50%) to 1.58(39.50%). However, the responses of the respondents with respect to Instrument Machinery shows that all the items are not adequate with average mean from 1.78(44.50%) to 1.27(31.75%). Only one item is not available (heavy duty grinding machine) with average mean 0.98(24.50%).

### Findings of the Study

1. The findings from the result of the study with respect MVMW from Table 1 indicated that basic MVMW hand tools are adequate, whereas, general servicing, reconditioning tools and other equipment are not adequate
2. With reference to workshop tools, equipment and instrument machinery in WFCP workshop from Table 2 the findings revealed that most of the hand tools are adequate. Majority of the equipment are not adequate. While the result on the instrument machinery shows that all the items are not adequate. Only one item is not available (heavy duty grinding machine)

### Discussion of Findings

The findings from the result of the study with respect MVMW from Table 1 indicated that basic MVMW hand tools are adequate, whereas, general servicing, reconditioning tools and other equipment are not adequate. The fact that the general servicing, reconditioning tools and other equipment are not adequate indicate that the students will not be able to acquire skills in those areas which is likely to have a negative effect on skill acquisition of the students that are passing through the programme. This confirms the study conducted by Ohwojero and Ede (2013) who stated that most automobile workshops in secondary schools and technical colleges have no tools and equipment. The few tools and equipment available in the workshop cannot be used. Based on this factor the students are not taught practical. The problem of lack of workshop tools and equipment has gone a long way to affect students' performance in MVMW programme at technical college level.

Ohwojero and Ede further stated that most tools equipment that are found in secondary and technical college MVMW workshops are not functional. The few available ones are not enough for students' usage during workshop practice. Also, they are not serviced as at when due after long usage. The non functionality of the tools and equipment in the schools workshop has effect on the workshop practice. This can lead to poor students' performance and interest in MVMW programme.

The findings with respect to workshop tools, equipment and instrument machineries in WFCP workshop shows that all items under the instrument machineries are not adequate. Anyakoha (1992) in support of the findings noted that the development of useful skills can be reinforced by the appropriate selection and use of learning facilities and resources. These comprises of workshop tools and equipment and other machineries. In the same vein Uzoagulu (1992), warned that where equipment and tools are not adequately provided, technical training programmes will suffer and will lead to the production of highly unskilled personnel who are unemployable and unproductive.

The findings of this study also corresponds with that of Onyene, Olusanya, Salisu and Johnson, (2007) in a study titled "The production of skill-oriented graduates for the labor market" which revealed that, the TVET is grossly suffering from inadequate physical and material resources for the teaching of technical subjects in Nigeria. The workshop tools and equipment are not available in most technical colleges where present, the equipment in the workshops and laboratories is often out-of-date, bearing little resemblance to the technologies presently used by industry (NICHE, 2010). The shortage of workshop tools, equipment and other facilities has contributed to the decrease in the quality of technical college graduates in Nigeria which make them lack the necessary skills for the actual the actual job performance.

### Conclusion

The inability of the technical college MVMW and WFCP graduate to put knowledge obtained from the school into practical use in actual job situation is as a result of lack of necessary skills required for actual work, which is as a result of lack of adequate workshop tools and equipment. This poses a challenge both to the government and other stakeholders involved in training the students. Steps should be taken to reverse this ugly situation in order to prepare technical college students adequately for employment in mechanical engineering related industries.

### Recommendations

Based on the findings the following recommendations: were made:

1. The government at both federal and state level should provide adequate funds for the purchase workshop tools, equipment and other machineries especially in mechanical engineering related programmes in technical colleges facilities
2. Non Governmental Organizations (NGOs), Parents Teachers Association (PTA), and Community Based Organizations (CBOs) should be encourage to support in supplying relevant workshop tools, equipment and other machineries as obtained in some nations
3. Industries should be sought as partners in progress to assist in provision of workshop tools, equipment and other machineries. This could be achieved through collaboration as technical colleges provide industry with a pool of potential employees.

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