Machining Practice Skills Required by Students of Metal Work in Technical Colleges for Self-Employment in Rivers State

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ABSTRACT
The study investigated the machining practice skills required by students of metal work in technical colleges for self-employment in Rivers State. One research question raised and one null hypothesis formulated guided the study. The study adopted a descriptive design. The population comprised 170 technicians and 49 technical education teachers in four NBTE accredited Government Technical Colleges in Rivers State. A structured questionnaire was used for data collection. The instrument was validated by three experts in Mechanical Technology from the, Rivers State University, Port Harcourt. The reliability index was established using Cronbach Alpha coefficient formula which yielded a reliability coefficient of 0.80 which was considered sufficient for the study. The data collected were analyzed using mean, standard deviation and z-test statistics. From the findings of the study it was revealed that all the listed items on machining skills are required by students of metal works in technical colleges for self-employment in Rivers State. Based on the finding of study, it was recommended among other things that metalwork teachers should be sensitized on communicating the different machining skills open to students, as well as how these skills will lead to employers’ workplace expectations. Also, government should encourage graduates of metalwork who have acquired machining skills to go into small scale business after graduation as this will aid in reducing unemployment in Nigeria.

Keywords: Metalwork, Drilling, Turning, Milling, self-employment, Machining skills.

INTRODUCTION
Unemployment has been identified as one of the major challenges of the 21st century and Nigeria as a nation is not spared by the scourge of unemployment. In most developing countries like Nigeria, governments and policy makers are increasingly finding it difficult to deal successfully with the problem of youth unemployment. Among other things, this high level of unemployment can be attributed to lack relevant marketable skills that will make them employable in industries or related organizations as well as self-employment (Audu, Kamin & Balash, 2013). The graduates of technical institutions are no exemption. As a result, students who graduate from technical institutions acquire little knowledge and practical skills that would enable them, on graduation to practice what was learnt in school, create jobs for themselves and participate in economic development (Okafor, 2011).

Technical and vocational job-specific skills relevant for self-employment can be acquired through the system of education offered by technical and vocational education and training [TVET] (Okoye & Okwelle, 2013). TVET is widely recognized as the most effective means of empowering the citizenry to stimulate sustainable national development, enhance employment,
improve the quality of life, reduce poverty, limit the incidence of social vices due to joblessness and promote a culture of peace, freedom and democracy (Okwelle, Beako, & Ajie, 2017). The Federal Republic of Nigeria [FGN] (2013) stated that TVET is used as a comprehensive term referring to those aspects of educational processes involving, in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. TVET is a type of education that seeks to address questions about unemployment.

Technical colleges are institutions where students are trained to acquire relevant knowledge and skills in different occupations for employment in the world of work (Emmanuel & Ariyo, 2014). According to NBTE (2011) technical colleges are post primary institutions where students are giving full vocational training that will enable them acquire relevant knowledge, skills and attitude for paid or self-employment in various occupations in the world of work. NBTE further stated that the quality of academic programmes in technical colleges is regulated by NBTE’s curriculum development, supervision and periodic accreditation visits. While the National Business and Technical Examinations Board (NABTEB) is responsible for the examination and certification of the occupational trades leading to the award of National Technical Certificate (NTC) and Advance National Technical Certificate (ANTC).

The trades offered in the Technical Colleges in Nigeria according to NBTE (2004) include the following: Building and Wood work trades, Business Trades, Computer trades, Electrical/Electronic trades, Hospitality trades, Printing trades, Textile Trades, General Education Courses, Automobile Trades, Printing Trades, Textile Trades, Hospitality and Mechanical Trades from which the metal works trade is subsumed. In Nigeria, metalwork trade as a vocational training programme are offered in Technical Colleges, companies and designated skills acquisition centers. Metalwork trade comprises of a blend of both theory and practical that leads to the production of goods and services by the use of tools, equipment and metalwork materials (NBTE, 2011). At the technical colleges, metalwork skills are evident in trades such as machine shop practice skills, welding skills, fabrication skills, forging skills, machining skills, foundry practices skills among others (Oranu, Nwoke, Ogwo as cited in Emmanuel & Ariyo, 2014).

According to Cranmer (2014) skill is an ability and capacity acquired through deliberate, systematic and sustained effort to smoothly and adaptively carryout complex activities or job functions involving ideas (cognitive skill) things (technical skills) and/or people (interpersonal skills). Technical skills are skills expertise or technical competence related to the field of The worker, whether engineering or technical (Medina, 2011). In this regard, Yakubu (2014) stated that the importance of metalwork to everyday life and the overall objective of vocational and technical education, that offers training in skill for self-employment and for employment into the world of work, has made metalwork become an important trade to be taught to students. Therefore, for the students to be trained in metal works skills for self-reliance, self-sufficiency and for employment in the world of work, they require the relevant technical skills in such area like machinig process among other.

Machining process is a term that evolved over the past one and a half centuries as technology has advanced. In the 18th century, the word machinist simply meant a person who built or repaired machines. This person's work was done mostly by hand, using processes such as the carving of wood and the hand-forging and hand-filing of metal. Therefore, during the Machine Age, machining referred to (what we today might call) the traditional machining processes, such as turning, boring, drilling, milling, broaching, sawing, shaping, planning, reaming, and tapping. In these "traditional" or "conventional" machining processes, machine tools such as lathes, milling machines, drill presses or others, are used with a sharp cutting tool to remove material to achieve a desired geometry (Naberrherm, 2013).

Presently, machining (turning, milling, and drilling) is the most widespread metal shaping process in mechanical manufacturing industry. According to Childs, Maekawa, Obikawa, and Yamane
machining include the various processes in which a piece of raw material is cut into a desired final shape and size by a controlled material-removal process. In the industry we have three principal machining processes which are classified as turning, drilling and milling. Other operations falling into miscellaneous categories include: shaping, planning, boring, broaching and sawing.

Turning operations are operations that rotate the work piece as the primary method of moving metal against the cutting tool. Lathes are the principal machine tool used in turning. Milling operations are operations in which the cutting tool rotates to bring cutting edges to bear against the work piece. Milling machines are the principal machine tool used in milling. Drilling operations are operations in which holes are produced or refined by bringing a rotating cutter with cutting edges at the lower extremity into contact with the work piece. Drilling operations are done primarily in drill presses but sometimes on lathes or mills.

**Statement of the Problem**

Federal Government of Nigeria (FGN, 2013) recognized the fact that technical education would provide training and impart the necessary skills to technical college students for self-reliance economically. FGN further stated that trainees who have completed the technical college programmes should be able to become self-employed and possibly employ others. To achieve the above stated objective, technical college metalwork students need to acquire relevant machining skills that will guarantee self-employment upon graduation.

Yakubu (2014) stated that one major challenge facing students of metal works trades upon graduation is the lack of competent knowledge and practical skills that will enhance self-reliance. Graduates of technical colleges who are supposed to be employers of labour are now job seekers (Ehimen & Ezeora, 2018). This seems as a defect in academic curriculum that prepares recipients with little or no jobs related skill contents. Ehimen and Ezeora further stated that in many cases, many technical college graduates compensate for insufficient academic preparation by undergoing trainings and remedial courses in different private technical workshops. Individuals that cannot afford to take the risk of undergoing this training end up not becoming self-employed thus multiply the number of unemployed graduates roaming the street of Rivers State in search for jobs. The skills, which are learnt while in school, are as a result of the skills embedded in the technical college curriculum and used in teaching the students. However, it may not be out of place to reason that if relevant machining process skills are imparted in metalwork technical college students, it will enable them become self-reliant, contribute to economic development of the country and in turn unemployment would be reduced to the barest minimum. Therefore, the problem of the study is to determine the machining practice skills that are required of students of metal works in technical colleges for self-employment in Rivers State?

**Purpose of the Study**

The purpose of the study is to determine the machining practice skills that are required of students of metal works in technical colleges for self-employment in Rivers State. Specifically, the study sought to:

1. Determine the machining practice skills are required by students of metal works in technical colleges for self-employment in Rivers State.

**Research Questions**

The following research questions guided the study.

1. What are the machining practice skills required by students of metal works in technical colleges for self-employment in Rivers State?

**Hypothesis**

The following null hypothesis tested at 0.05 level of significance guided the study.

1. There is no significant difference in the mean ratings of metal work technicians and metal work teachers/instructors on the machining practice skills required by students of metal works in technical colleges for self-employment in Rivers State.
METHODS AND MATERIALS

The descriptive survey design was adopted for the study. The study was carried out in Rivers State Nigeria. The population of the study comprised 219 respondents, 170 technicians from registered metalwork teachers/instructors in the four NBTE accredited Government Technical Colleges in Rivers State. The study was a census as the entire population was studied. Metalwork Skills for Self-employment (MWSSE) questionnaire was the instrument used to gather data in the study. The MWSSE was structured based on 4 – point scale of highly required (HR), moderately required (MR), slightly required (SR) and not required (NR) with corresponding numerical values of 4,3,2 and 1 respectively. The instrument was validated by three experts in the Vocational and Technology Department of Rivers State University. Cronbach Alpha coefficient formula was used to determine the internal consistency of the instrument and the reliability coefficient value obtained was 0.80, which represents a high reliability coefficient for the study.

Out of the 219 copies of the instrument distributed to the respondents, 199 copies only were completely filled and retrieved, giving rise to 95% return rate. Research questions were analysed with mean and standard deviation while hypothesis were tested with z-test statistics at 0.05 level of significance. For the research questions, it was decided that an item with mean real limit equal and above 2.50 was regarded as required while on the other hand, an item with mean real limit less than 2.50 was regarded as not required. Standard deviation values close or wide apart were used to determine the homogeneity in opinion among the respondents. The decision for hypothesis was that if the calculated value of t (tcal) is less than the critical value of t (tcrit), the hypothesis is not rejected but if (tcal) is greater than (tcrit), he hypothesis is rejected.

RESULTS

Research Question

1. What are the machining practice skills required by students of metal works in technical colleges for self-employment in Rivers State?

Table 1: Machining Skills Required by Students of Metal Works in Technical Colleges for Self-Employment.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Machine Shop Practice Skills</th>
<th>Metalwork Technicians</th>
<th>Metalwork Teachers/Instructors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>X</td>
<td>SD</td>
</tr>
<tr>
<td>A.</td>
<td>Milling: Ability to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Set the machine for milling Operation</td>
<td>3.39</td>
<td>.837</td>
</tr>
<tr>
<td>2</td>
<td>Sharpen milling cutters</td>
<td>3.53</td>
<td>.826</td>
</tr>
<tr>
<td>3</td>
<td>Mill parallel and square surface with a milling machine</td>
<td>3.10</td>
<td>.939</td>
</tr>
<tr>
<td>4</td>
<td>Mill angular surfaces</td>
<td>3.11</td>
<td>.772</td>
</tr>
<tr>
<td>5</td>
<td>Select indexing plate - Hexagonal, pentagonal</td>
<td>2.97</td>
<td>.986</td>
</tr>
<tr>
<td>6</td>
<td>Set the sector arm</td>
<td>3.04</td>
<td>.755</td>
</tr>
<tr>
<td>7</td>
<td>Produce large range of circular division by using indexing Hard</td>
<td>3.09</td>
<td>.903</td>
</tr>
<tr>
<td>8</td>
<td>Mount and align the cutters</td>
<td>3.11</td>
<td>.994</td>
</tr>
<tr>
<td>9</td>
<td>Produce a seat for flat surfaces</td>
<td>3.32</td>
<td>.841</td>
</tr>
<tr>
<td>10</td>
<td>Mill two surface parallel at one setting.</td>
<td>3.28</td>
<td>.940</td>
</tr>
<tr>
<td>11</td>
<td>Produce multiple surfaces at one passage of the cutter</td>
<td>2.75</td>
<td>.982</td>
</tr>
<tr>
<td>12</td>
<td>Mount the cutters desired to produce the required profile ensuring the elimination of end thrust</td>
<td>3.05</td>
<td>.833</td>
</tr>
<tr>
<td>13</td>
<td>Maintain the milling machine</td>
<td>3.14</td>
<td>.953</td>
</tr>
<tr>
<td>14</td>
<td>Set up the machine for milling Operation</td>
<td>2.59</td>
<td>1.142</td>
</tr>
</tbody>
</table>
B. **Shaping, Planning and Slotting:**
   **Ability to:**
   - Set and operate the shaper to produce various components applying safety precautions
   - Clean, oil and grease the shaping machine and adjust the slides
   - Adjust the length of stroke and mount work and tool correctly
   - Carry out the planning operations observing safety precautions
   - Clean, oil, grease and adjust the slides of the panning machine
   - Calculate the working speed of slotting machine average cutting speed

C. **Drilling: Ability to**
   - Practical safety in the work place.
   - Drill to specification applying the correct lubricant and observing the safety precautions
   - Grind drills to the correct angles.
   - Set up tools for counter boring, counter sinking and facing operations
   - Machine the seating as required for cheese head bolts or screw, counter sunk head screw etc (observe safety precautions)

D. **Grinding: Ability to**
   - Clean, operate and match the following grinding machine with their uses
   - Maintain any grinding machines
   - Cleaning the machines at regular intervals during use and at the end of the day
   - Top up oil level
   - Grease the machine
   - Adjust the slides at the end of the day
   - Interpret wheel specification and mount it on the spindle
   - Test a grind wheel for soundness
   - Clean, mount and operate work holding devices for a surface grinder e.g. permanent and electro-magnetic chuck
   - Carry out surface grinding operation to angular operation to angular and cylindrical surfaces
   - Select, inspect and operate work holding devices for a cylindrical grinder e.g. centers and the clog, work rest in the case of a long work piece
   - Carry out cylindrical operation to external surfaces
   - Carry out centerless grinding operations Practicing
   - Calculate the wheel speed (S) of a grinding machine using the formulae
E. **Turning: Ability to**

40 Select and grind to The correct angles lathe tool cutters/bits for different materials/operations 2.88 .880 HR 3.07 .838 HR

41 Operate The lathe to produce a piece of job to Specification 2.84 .882 HR 3.09 .808 HR

42 Cleaning and lubricating The machine 3.34 .797 HR 3.04 .947 HR

43 Select work holding devices 3.16 .902 HR 3.19 .766 HR

44 Determine the sequence of operation 2.70 1.059 HR 3.12 .982 HR

45 Carry out related calculation 2.86 1.025 HR 3.39 .774 HR

46 Eccentric turning 3.17 .891 HR 3.19 .860 HR

47 Clean the machine 3.25 .830 HR 3.26 .856 HR

48 Oil the machine 3.23 .834 HR 3.32 .776 HR

49 Adjust slides 3.40 .821 HR 3.21 .725 HR

50 Replace components due for replacement instruction 3.09 .722 HR 3.10 .55 HR

51 Calculate the angle for taper turning 3.18 .658 HR 3.23 .881 HR

52 Calculate the angular error in taper turning derived from tool setting 3.05 .924 HR 3.44 .926 HR

53 Determine the work plan for a turning job 3.19 .953 HR 3.11 .858 HR

54 Interpret working drawings 2.99 .881 HR 3.26 .897 HR

55 Select work holding devices 2.95 .990 HR 3.09 .989 HR

56 Determine the sequence of operation 2.98 1.033 HR 3.18 .889 HR

57 Select appropriate tools and materials 3.19 1.043 HR 2.97 .954 HR

**Grand Mean** 3.13 0.87 HR 3.19 0.87 HR

**Source:** Researcher’s field work 2019.

Data in Table 1 revealed that metal work technicians had a mean range of 2.59-3.53 and standard deviation range of 0.75-1.14 in milling. The technicians also had a mean range of 2.93-3.56 and standard deviation range of 0.73-1.00 in shaping, planning and slotting, they had a mean range of 3.23-3.40 and standard deviation range of 0.50-0.83 in drilling. 2.93-3.32 and 0.55-104 in grinding, 2.70-3.34 and 0.72-1.05 in turning. While the metal work teachers had a mean range of 2.81-3.57 and standard deviation range 0.69-1.03 in milling. The metal work teachers also had a mean range of 3.09-3.42 and standard deviation range of 0.51-0.86 in shaping, planning and slotting. They had a mean range of 2.92-3.14 and standard deviation range of 0.51-0.95 in drilling. 2.98-3.44 and 0.55-0.92 in grinding and 2.70-3.34 and 0.55-0.98 in turning. The standard deviation showed the homogeneity of the respondents’ opinion. This indicates that the both respondents agreed that machining skills are required by students of technical colleges for self-employment in Rivers State.

**HO:** There is no significant difference in the mean rating of metal work technicians and metal work teachers/ instructors on the machining practice skills required by students of metal works in technical colleges for self-employment in Rivers State.

**Table 2: T-test analysis on Machining Skills Required by Students of Metal Works in Technical Colleges for Self-employment**

<table>
<thead>
<tr>
<th>Respondents</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>P-value</th>
<th>df</th>
<th>t-cal</th>
<th>t-tab</th>
<th>RMK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers/Instructors</td>
<td>49</td>
<td>3.14</td>
<td>.87</td>
<td>0.05</td>
<td>197</td>
<td>1.03</td>
<td>1.69</td>
<td>No Sig</td>
</tr>
<tr>
<td>Technicians</td>
<td>150</td>
<td>3.19</td>
<td>.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Researcher’s Field Work 2019.
Result in Table 2 revealed that t-cal (1.03) which is less than t-crit (1.69), indicating that the null hypothesis stated was accepted. Therefore, there is no significant difference between the mean responses of mechanical teachers and instructors on machining practice skills required by students of metal works in technical colleges for self-employment in Rivers State.

**DISCUSSION**

The finding of the study in Table 1 revealed that metal work technicians and the teachers/Instructors rated all the 57 items on machining practice skills as highly required by students of metal works in technical colleges for self-employment in Rivers State. This finding is consistent with the report of Okwelle and Orlu (2020) that in reducing unemployment among metalwork technical college students there is need to impart good foundry pattern making skills as this will help them in establishing small scale business after graduation. Thus if these skills are incorporated into the curriculum of technical colleges, it will provide the graduates of these colleges with saleable skills necessary for gainful employment and self-reliance. This will to an extent address the observation of Yakubu (2014) who stated that one major challenge facing students of metal works trades upon graduation is the lack of competent knowledge and practical skills that will enhance self-reliance. The null hypothesis in the study was accepted as shown in Table 2, indicating that indication that both categories of trainers of technical college students in metalwork do not differ in their opinions over the relevant machining practice skills required by students of technical colleges for self-employment in Rivers State.

**CONCLUSION**

Technical colleges in Nigeria are set up to equip youths in different trades, either paid or self-employed. This study on metal works skills required by students of technical colleges for self-employment in Rivers State is as a result of the technical manpower in the 21st-century labour market demands which have caused many metalwork graduates with various certificate to be unemployed. For Nigeria to rise above the problem unemployment among metalwork technical college students there is need to impart sound machining process skills as this will help them to be self-employed without necessarily waiting for white-collar jobs.

**RECOMMENDATIONS**

Base on the findings of study, the following recommendations were made:

1. Government should encourage non-government organizations (NGO) to sponsor and organized seminars, conferences, workshops and symposia for metalwork technical teachers and metalwork instructors in technical colleges in Rivers State to sensitize them on communicating The different machining skills open to students, as well as how These skills will lead to employers’ workplace expectations.

2. Administrators of technical colleges should always organize programmes to improve The quality of graduate of machine practice as these will help in addressing the issue of negative attitudes and perceptions of students towards metalwork practice.

3. Government should encourage graduates of metalwork to go into entrepreneurship business after graduation since they have acquired machining skills such as drilling, tuning, milling, grinding etc.

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