International Journal of Modern Innovations &Knowledge (IJMIK)
ISSN:2734-3294
Available on-line at:www.ijmik.com

Volume 1 / Issue 1 / 2020

Safety Practices Required of Mechanical Engineering Craft Practice Students in Handling Equipment in Technical Colleges in Rivers State

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Citation: Obed, O.O., Eyong, S. O. I., T. M. Deebom. & Ovundah, A. (2020). Cosmetology Skills Required for Entrepreneurship Development among Home Management Students in Secondary Schools in Rivers State. *International Journal of Modern Innovations & Knowledge, 1(1)*; 52 - 63

Received on 18th May 2020; Accepted 11th June 2020 Published 23rd June 2020

Abstract

The study focused on the safety practices required of mechanical students in handling equipment in technical colleges in Rivers State. Two purposes, research questions and hypotheses guided the study. This study adopted a descriptive survey research design and was carried in Rivers State. The population of the study was 160 respondents, comprising 22 teachers and 138 mechanical students in the technical colleges in Rivers State. Data were collected through a self-structure questionnaire. The instrument contains four sections A-D. Section A elicited information on personal data of the respondents. The instrument was partition in to various and after Liketr-5-point rating scale of agreement. The instrument was face-validated by two experts and has 0.81 reliability index. The findings of the study revealed that safety practices are required by mechanical engineering craft students in handling hand and machine tools in technical colleges. It was recommended that strict measure should be employed to ensure that workshop technicians/assistants employed to manage mechanical workshops are those trained for the job. Workshop technicians should be involved in routine retraining, workshops and seminars to help them acquire the skills as well as to keep them abreast with the important innovative safety practices for effective mechanical workshop management.

Keywords: Safety Skills Mechanical Engineering Craft, Hand Tools, Machine Tools

Introduction

Technical education is an aspect of education that leads to acquisition of practical and applied skills as well as basic scientific knowledge (Federal Republic of Nigeria, 2013). Technical education is the foundation of nations' wealth and development. According to Ogundola, Abiodun and Oke (2010), it is a type of education that is meant to produce skilled and technical manpower necessary to restore, re-vitalize, energize, operate and sustain the national economy and substantially reduce unemployment. It is the form of education

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 the economic and social life (FRN, 2013). Okorie (2010) referred to technical education as "the phase of education which seeks to help the students acquire special mechanical or manipulative skills required in industrial arts or applied science. The specialized education is offered in technical institutions, including Technical Colleges, saddled with the responsibility of training low and middle level manpower. Technical colleges are institutions that equip students with technical skills that enable them work in the industries and also progress to study in the technical education and other related discipline in higher institutions. Technical Colleges in Nigeria are established to produce craftsmen and master craftsmen (Federal Ministry of Education, 2013). The courses offered at the Technical Colleges lead to the award of National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC). The programmes of Technical Colleges, according to Federal Government of Nigeria (2013) are grouped into related trades. These include construction trades, computer trades, electrical/electronic trade, textile trades, Business trades, printing trades and mechanical trades.

Similarly, the National Business and Technical Examinations Board (NBTE, 2007) opined that mechanical trade is a general name used in describing tread that have direct bearing with metal, welding/forming or servicing/repairs of machines or machine related equipment and appliances. The treads in this group include Agricultural implement and equipment, mechanic works, Auto body repair and spray painting, Auto electrical work, auto body mechanic works, Auto mechanic works, Auto building, Auto parts merchandising, Air-conditioning and Refrigeration mechanic works, welding and fabrication engineering craft practice, Foundry craft practice, Instruments mechanic works, Marine engineering craft and Mechanical engineering craft practice.

Mechanical Engineering Craft Practice (MECP) is a trade that provides a post primary technical education and practical proficiency in fitting, turning and machining to the level of good craftsman. Mechanical Engineering Craft Practice trade is one of the trades found in technical colleges, which is aimed at training and imparting necessary skills leading to the production of craftsmen who will be self-reliant and enterprising in job areas, such as metal fitting, machining, welding, fabrication and so on. Mechanical craft practice trade is also one of the branches of engineering which deals with machines and mechanized processes, particularly concerned with utilization of tools and equipment. According to the West African Examination Council (WAEC, 2004), the subject matter of mechanical engineering

craft practice is specifically designed to provide the skills and knowledge to fulfill the needs of the modern industry. The scheme has been devised in two main stages, part I and part II. Provision was also made for supplementary courses of more specialized character for those who may wish to pursue their studies a stage further after obtaining their part II certificate. Throughout the course emphasis is on practical training and theoretical knowledge, with such general studies as are essential for a sound understanding of the craft practice. The mechanical craft practice workshop is made up of hand and machine tools of various types that if not properly handle may lead to accident which is hazardous to teachers and students during instructional delivery. Hence, Deebom and Ojobah (2018) asserted that to reduce accidents and to make technical college safe for quality instructional delivery, safety must be adhering to. Without safety, lives and properties of the students and teachers will be threatened which will affects service delivery in the school…which implies that expertness, dexterity and practice of skills are required for quality instructional delivery in technical colleges (Deebom & Ojobah, 2018). In performing a skillful job, safety needs to be practiced.

For the purpose of enhancing efficiency and effectiveness of Technical College education where craftsmen and master craftsmen are prepared, it is necessary to identify the safety practices in handling equipment that are mechanically, electrically, electronically or manually driven (NTBE, 2006). This is because if safety in practiced in Technical Colleges, it will reduce accident occurrence that may lead to damage of properties and even loss of lives.

Safety is a state of being free from harm. It is of paramount concern to both workers and students. Students and even parents are much more interested in the level of safety provided in a occupation. Graduates who possess required safety practices would always fair better in an occupation, especially technical occupations. The knowledge of safety practices by Mechanical Engineering Craft Practice (MECP) students in technical colleges is an essential prerequisite for effective use of tools and machines in the workshop. Skilled worker in mechanical related occupations is not just someone who can perform any mechanical job correctly but a worker who can complete every job safely (Oranu, Nwoke & Ogwo 2002). Safety has become a major determinant for effective and successful performance of skilled personnel. Safety Practice is a fundamental requirement of any job in many establishments today. If good quality safety practice is properly applied and effectively implemented in different workplaces and technical college workshops, it would reduce incessant workplace accidents to workers and students (Deebom & Ojobah, 2018). In the view of Olaitan, Nwachukwu, Igbo, Onyeamaechi and Ekon (1999), safety is the art of taking precaution for

the avoidance or reduction of accidents in order to protect people and property. Oranu, Nkowe and Ogwo (2002) further view safety as the ability to perform every simple task involved in a job without causing damage to tools, equipment or materials used in performing the task. Safety practice is the ability to perform a task with necessary precautionary measures exhibited for the purpose of preventing accidents. Practice means doing something repeatedly in order to improve performance. For students to perform a task with little or no record of accidents in mechanical workshop, certain related practices such as selection of right tools for a job, use of insulated hand tools for electrical work, use appropriate tools for a specific operation, protect hands with gloves and wear safety shoes when operating portable tools and machines, wear approved eye protector when operating a power tool, use brush to remove chips from drilling machine, test the power tool or machine for functionality before use and remove the plug of the power tool or machine before making any adjustment among others are required of them in handling machine tools, hand tools, and consumables.

Machine tool is a device consisting of fixed and moving parts that modifies mechanical energy and transmits it in a more useful form (Olusegun, 2003). Machine in the view of Mukta (2007) is an apparatus with moving parts for converting mechanical energy into electrical energy or vice versa such as generator or motor, acting either on electromagnetic or electrostatic principles, but not including stationary apparatus such as transformers. Machines are, therefore, mechanical or electrical devices for technical operations. However, machine tools are used with consumables for smooth operations in the workshop. Hand tools are instrument or devices that can be handled easily while carrying out special operation as well as instructional and learning activities (Ahmed 2011). Mechanical engineering craft hand tools are commonly utilized in transmitting knowledge in the workshop or field to the learners. They are used in demonstrations, practices for learning of skills and for skills testing in specified professional and mechanical areas. Handling mechanical hand tools simply means using hand to operate or control such tool. They are made of woods and metal, very easy to manipulate. These tools need to be handled carefully to avoid accident through effective application of safety practices in Technical Colleges in Rivers State.

Safety Practice is a fundamental requirement of any job in many establishments today. If good quality safety practice is properly applied and effectively implemented in different workplaces and technical college workshops especially in Rivers State, it would reduce incessant workplace accidents to workers and students. It will also prolong the service lives of machines, tools and equipment and drastically reduce wastage (Anaele, Adelakin &

Olumoko, 2014). For prolong lives of teachers and equipment in handling equipment in Mechanical Engineering Craft Practice in Technical Colleges in Rivers State, there is the need that safety practices must be instill into the students and teachers to reduce or avoid accident in the workshop.

Statement of the Problem

The objectives of Mechanical Engineering Craft Practice (MECP) is to prepare and convey the essential skills important to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self-reliant. The National Business and Technical Education Board (NABTEB, 2001) affirmed that 65% of the time is allocated to practical session of mechanical engineering craft practice in technical colleges in Rivers State to teach the subjects which enables the students to mastered the tread, but due to loss of tools and machines as well as constant occurrence of accidents that lead to sustenance of injuries and electric shock, many students have been skeptical to participate in practical activities in mechanical workshop and as such, shy away from participation. Yakubu (2004) confirmed that students in Technical Colleges often absent themselves from school during practical lessons. This, according to Yakubu, was attributed to the accidents the students experience in the workshops. Also, Deebom and Ojobah (2018) found that accidents in the workshop affects students' thinking ability (cognitive), students writing or hand skills (psychomotor), students' reasoning ability (affective) and causes facial damage. Similarly, damages to tools and machines as well as accidents occurring in electrical workshop in Technical Colleges in River States seem to have instilled fear into the students which has made them to be absent during practical work. It is against these observed backdrops that this study sought to examine the safety practices required of mechanical students in handling Mechanical Engineering Craft equipment in Technical Colleges in Rivers State

Purpose of Study

The general purpose of this study is to investigate the safety practices required of Mechanical Engineering Craft Practice students in handling equipment in Technical Colleges in Rivers State. Specifically, the study sought to determine:

1. Safety practices required of Mechanical Engineering Craft students in handling hand tools in Technical Colleges in Rivers State.
2. Safety practices required of Mechanical Engineering Craft students in handling machine tools in Technical Colleges in Rivers State.

Research Question

Three research questions guided the study:

- What are the safety practices required of mechanical engineering craft students in handling hand tools in technical colleges in Rivers State?
- What are the safety practices required of mechanical engineering craft students in handling machine tools in technical colleges in Rivers State?

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

HO_1: There is no significant difference in the mean response of Mechanical Engineering Craft Practice teachers and students on the safety practices required of mechanical engineering craft students in handling hand tools in technical colleges in Rivers State.

HO_2: There is no significant difference in the mean response of Mechanical Engineering Craft Practice teachers and students on the safety practices required of mechanical engineering craft students in handling machine tools in technical colleges in Rivers State.

Methodology

This study adopted a descriptive survey research design. According to Gall, Gall and Borg (2007), a survey research is a method of data collection in which questionnaires or interview is utilized in collecting data from a sample that has been selected to represent a population to which the findings of the data analysis can be generalized. The study was carried out in four Technical Colleges in Rivers State which include GovernmentTechnicalCollege, Port Harcourt, Ahoada, Tombia and Ele-ogu respectively. Rivers State has companies and industries that need the graduates of Mechanical Engineering Craft Practice to handle and operate both power and hand machines in the industries. The population of the study was 160 respondents, comprising 22 teachers and 138 students of Mechanical Engineering Craft Practice from four technical colleges in Rivers State. The entire population was used since the population is of manageable size. Hence, there was no sampling.

A structured questionnaire instrument was used to collect data for this study titled "Mechanical Engineering Craft Safety Practice Questionnaire (MECSPQ)". The instrument was developed after the review of relevant literature on safety practices required of mechanical students in handling equipment in technical colleges in Rivers State. The instrument contains four sections A-D. Section A elicited information on personal data of the respondents. Section B elicited data on safety practices required of mechanical engineering craft students in handling hand tools in technical colleges in Rivers State. Section C elicited

data on safety practices by mechanical engineering craft students in handling machine tools in technical colleges in Rivers State and section D elicited data on safety practices required of mechanical engineering craft students in handling consumable materials in technical colleges in Rivers State. The instrument is structured on a Likert-5-point response options of Strongly Agreed (SA), Agreed (A), Undecided (U), Disagreed (D) and Strongly Disagreed (SD) with values of 5, 4, 3, 2, and 1 respectively.

The instrument was face-validated by two experts. One from the Department of Technical Education, Ignatius Ajuru University of Education, Port Harcourt and one from Technical college, Port Harcourt. To establish the reliability of the instrument, 30 copies of the questionnaires were trial-tested teachers and students in BayelsaState. On the return of the instrument, Cronbach Alpha reliability coefficient formula was used to determine the reliability of the instrument. This yielded 0.81 reliability index.

The researchers administered the questionnaire personally on the respondents. The completed copies of the questionnaire were also retrieved by the researchers for data analysis. Data collected from the respondents were analysed using mean and standard deviation to answer the research questions. The t-test statistics was used to test the null hypotheses at 0.05 level of significance. For research questions, the decision was to agree an item if mean calculated is greater than or equal to 3.50. On the other hand, disagree an item if mean calculated is less than 3.50. The hypotheses were tested at 0.05 level of significance using t-test. If the calculated value of t (tcal) is less than the critical value of t (tcrit), the hypothesis was accepted but if the calculated value of t (t-cal) is greater than or equal to the critical value of t (t-crit), the hypothesis was rejected. The data were analysed with the aid of Statistical Package for Social Science (SPSS).

Results

Research Question 1: What are the safety practices required of Mechanical Engineering Craft students in handling hand tools in Technical Colleges in Rivers State?

Table 1: Mean and Standard Deviation on Safety Practices Required of Mechanical Engineering Craft Students in Handling Hand Tools

S/N	Item Statement	Teachers			Students		
		$\bar{X}$	SD	RMK	$\bar{X}$	SD	RMK
1	Select right tools for the job	3.57	0.69	SA	3.81	1.04	A
2	Use tools with a good handle always	3.56	0.73	SA	4.11	0.85	A
3	Avoid using tools without handles	4.31	0.78	A	4.16	0.92	A
4	Check the sharpness of hack saw blades, scribers, punch and screwdrivers before	4.28	0.75	A	4.35	0.72	A

	use						
5	Use appropriate tools for a specific job or operation	4.93	1.00	A	3.95	0.93	A
6	Know the capacity of any tool before using it for any work	4.16	0.94	A	4.42	0.84	A
7	Use insulated hand tools for electrical work	4.95	0.87	A	4.09	0.86	A
8	Put finger behind the tip of the screwdriver while screwing	4.25	0.93	A	4.32	0.74	A
9	Use correct size of screwdrivers for work	4.99	1.08	A	4.31	0.79	A
10	Give a tool to colleague through the handle	4.05	0.99	A	4.42	0.64	A
	Grand Mean	**4.31**	**0.88**	**A**	**4.19**	**0.83**	**A**

Source: *Researchers' Field Result, 2020*

Data in Table 1 revealed that teachers had a mean range of 3.56 - 4.99 and standard deviation range of 0.69 - 1.08 while the students had a mean range of 3.81- 4.42 and standard deviation range of 0.71-1.04. The standard deviation shows the homogeneity of the respondents. The mean shows that the respondents agreed on the safety practices required of mechanical engineering craft students in handling hand tools in technical colleges in Rivers State.

Research Question 2: What are the safety practices required of mechanical engineering craft students in handling machine tools in technical colleges in Rivers State?

Table 2: Mean and Standard Deviation on Safety Practices Required of Mechanical Engineering Craft Students in Handling Machine Hand Tools

		Teachers			Students		
S/N	**Item Statement**	$\overline{X}$	**SD**	**RMK**	$\overline{X}$	**SD**	**RMK**
11	Protect hands with gloves and wear safety shoes when operating portable tools and machines	4.23	0.84	A	4.07	0.83	A
12	Wear approved eye protector when operating a power tool	4.40	0.82	A	4.09	0.81	A
13	Stop power tools or machines before cleaning activities or making any adjustment	4.09	0.72	A	4.04	0.95	A
14	Disconnect the power tools or machine immediately the work is done	4.18	0.66	A	4.19	0.77	A
15	Disconnect the power tool or machine immediately a strange sound is noticed	4.05	0.92	A	4.12	0.98	A
16	Remove the plug of the power tool or machine before making any adjustment	4.19	0.95	A	4.39	0.77	A
17	Test the power tool or machine for functionality before use	3.99	0.88	A	4.19	0.86	A
18	Keep the body away from the rotating part of the power tool/machine	3.95	0.99	A	4.26	0.85	A
19	Never put the whole-body weight on portable drill while drilling	3.98	1.03	A	4.32	0.76	SA
20	Never adjust any power tool or machine while running	4.19	1.04	A	4.21	0.73	A
21	Check faults in the power tool or machines before re-use	4.23	0.88	A	4.34	0.79	A

22	Use brush to remove chips from drilling machine	4.44	0.93	A	4.16	0.90	A
23	Remove all hand tools from power tools or machines table	4.11	0.85	A	3.70	1.01	A
24	Remove power tools and machines from the power source after use	4.26	0.89	A	3.86	1.02	A
25	Concentrate on work while using power tool or machine	4.09	0.98	A	4.17	0.89	A
	Grand Mean	**4.08**	**0.89**	**A**	**4.11**	**0.87**	**A**

Source: *Researchers' Field Result, 2020*

Data in Table 2 revealed that teachers had a mean range of 3.59 - 4.44 and standard deviation range of 0.65 - 1.04 while the students had a mean range of 3.70 - 4.39 and standard deviation range of 0.72-1.05. The standard deviation shows the homogeneity of the respondents. The mean shows that the respondents agreed on the safety practices required of mechanical engineering craft students in handling machine tools in technical colleges.

Hypotheses

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

HO_1: There is no significant difference between the mean response mechanical teachers and students on the safety practices required of mechanical engineering craft students in handling hand tools in technical colleges in Rivers State.

Table 3: t-Test Analysis on Safety Practices Required of Mechanical Engineering Craft Students in Handling Hand Tools.

Category	N	$\overline{X}$	SD	df	t-cal	t-crit	RMK
Teachers	22	4.31	0.88				
				158	1.23	1.96	Accepted
Students	138	4.19	0.83				

Source: *Researchers' Field Result, 2020 Accept* Ho if tcal ≤ tcrit; otherwise reject Ho.

Result in Table 3 revealed that t-cal (1.23) is less than t-crit (1.96) which indicates that the hypothesis stated was accepted. Therefore, there is no significant difference between the mean response mechanical teachers and students on the safety practices required of mechanical engineering craft students in handling hand tools in technical colleges in Rivers State.

HO_2: There is no significant difference between mean response mechanical teachers and students on the Safety practices required of mechanical engineering craft students in handling machine tools in technical colleges in Rivers State.

Table 4: t-Test Analysis on Safety Practices Required of Mechanical Engineering Craft Students on Handling Machine Tools.

Respondents	N	$\overline{X}$	SD	df	t-cal	t-crit	RMK

Teachers	22	4.08	0.89				
				158	1.21	1.96	Accepted
Students	138	4.11	0.87				

Source: *Researchers' Field Result, 2020 Accept* Ho if tcal ≤ tcrit; otherwise reject Ho.

Result in Table 4 revealed that t-cal (1.21) is less than t-crit (1.96) which indicates that the hypothesis stated was accepted. Therefore, there is no significant difference between the mean response mechanical teachers and students on the safety practices required of mechanical engineering craft students in handling machine tools in technical colleges in Rivers State.

Discussion of Findings

Data in Table 4.1 revealed that teachers had a mean range of 3.56 - 4.99 and standard deviation range of 0.69 - 1.08 while the students had a mean range of 3.81-4.42 and standard deviation range of 0.71-1.04. The standard deviation shows the homogeneity of the respondents. The mean shows that the respondents agreed on the safety practices required of mechanical engineering craft students in handling hand tools in technical colleges. Result in Table 3 revealed that t-cal (1.23) is less than t-crit (1.96) which indicates that the hypothesis stated was accepted. Therefore, there is no significant difference between the mean response mechanical teachers and students on the safety practices required of mechanical engineering craft students in handling hand tools in technical colleges in Rivers State. The findings of the study are in line with Yakubu (2004) who stated that hand tools do not usually cause accidents if they are in working order, used correctly, carried carefully and stored safely. The findings also were in consonance with the opinion of Ede, Milter, and Bakare (2011) who said that available tools should be classified according to usage and they should be properly serviced before embarking on a new job. It is necessary therefore for electrical installation students to take adequate measures while carrying out any activity in the workshop.

Data in Table 4.2 revealed that teachers had a mean range of 3.59 - 4.44 and standard deviation range of 0.65 - 1.04 while the students had a mean range of 3.70 - 4.39 and standard deviation range of 0.72 - 1.05. The standard deviation shows the homogeneity of the respondents. The mean shows that the respondents agreed on the safety practices required of mechanical engineering craft students in handling machine tools in technical colleges. Result in Table 4 revealed that t-cal (1.21) is less than t-crit (1.96) which indicates that the hypothesis stated was accepted. Therefore, there is no significant difference between the mean response mechanical teachers and students on the Safety practices required of mechanical engineering craft students in handling machine tools in technical colleges in Rivers State. The findings of the study agree with Oranu, Nwoke and Ogwo (2002) that the

users or operators of power machines and tools should always wear eye goggles when drilling machines. The result is also in agreement with Bakare (2010) that operators should always wear face shield when using drilling machines and make sure that the switch is off before connecting drilling machine to source.

Conclusion

The study has revealed the fact that safety in the workshop is everybody's business indeed because all and everything including the workshop technicians/assistants, teachers, students, tools, materials and equipment suffer in the face of unsafe work conditions. Safety in this regard should be from external and internal forces in form of risks to life, tools and equipment and the workshop environment. The need for workshop technicians and indeed teachers to acquire safety skills was established, especially in the face of rampant occurrence of accidents and other avoidable hazards in the school workshops. When the workshop technicians consciously and unconsciously protect themselves, others, tools, equipment and the environment, the job of teaching and learning no doubt, will be a pleasurable one. The findings of the study showed that safety practices are required by mechanical engineering craft students in handling hand and machine tools in technical colleges in Rivers State.

Recommendations

From the findings of this study, the following recommendations are made:

1. Strict measure should be employed to ensure that workshop technicians/assistants employed to manage mechanical workshops are those trained for the job.
2. Workshop technicians should be involved in routine retraining, workshops and seminars to help them acquire the skills as well as to keep them abreast with the important innovative safety skills for effective mechanical workshop management.
3. Obsolete and faulty equipment which could constitute treat to safety should be replaced, repaired or serviced as the case warrant.
5. Workshop rules and regulations especially as it borders on machine and human safety must be emphasized.

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