



Workshop Safety Skills Required by Students of Electrical Installation and Maintenance Works for Improved Workmanship

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Abstract. Wrong handling of tools and equipment in the college workshop could cause accident and damages to the tools and equipment being used. Therefore, there is need to ascertain workshop safety skills required by technical college students, including electrical installation and maintenance works students in handling tools and equipment in technical colleges in Edo State, Nigeria. Three specific purposes were determined and three research questions guided the study. One null hypothesis was formulated and tested at 0.05 level of significant. The study adopted descriptive survey research design. The population of the study was 64 technical teachers currently serving in the four technical colleges offering electrical installation and maintenance works in Edo State. The entire population was used as the sample size because it was manageable, hence a census. A four-point modified scale structured questionnaire was the instrument used for data collection. The instrument was validated by three experts from the Faculty of Vocational and Technical Education, University of Benin and it has a reliability coefficient of 0.72. Mean, standard deviation and Z-test were the statistical tools used for data analysis. Analysis of data revealed that electrical installation students require safety skills for handling electrical installation hand tools, machine tools and skills for working in the electrical workshop environment. It was concluded that electrical installation students require workshop safety skills to prevent workshop accident thereby improving workmanship within and outside the college workshop. It was recommended, among others, that electrical installation teachers should continue to teach and make students to be acquainted with workshop safety skills to prevent workshop accident and damages to tools and equipment.

Keywords: Workshop; Skills; Electrical Installation; Technical College and Improved Workmanship.

1. Introduction

Electrical installation is a subject taught in vocational and technical colleges. It consists of these components: domestic and industrial installations; cable joining; battery charging and repairs and winding of electrical machines (NBTE, 2014). Electrical installation and maintenance works (EIMW) is of two parts: theory and practical. In the college lesson time table, more time is allocated to the practical aspect of the EIMW. According to Eze and Osuyi (2018), this obvious emphasis is to make students spend more time for workshop practice so that they would be grounded in installation practice. Grondzik and Kwok (2019) states that electrical installation students are equipped with the basic skills required to operate, maintain, install and repair electrical equipment and appliances. Electrical workshops play vital roles in this regard, as students learn, develop and perform many functions with electrical equipment to expand their scientific knowledge and manual dexterity. Electrical workshops could become the center of physical hazards, including fire, electrocution and emissions when a tool is mishandled, stored improperly, or safety precautions are not observed. Therefore, it becomes imperative for electrical installation students to become acquainted with the safety skills necessary in handling workshop tools and equipment to prevent accident.

Safety is a necessary onus for human survival and existence. Most careers chosen by man have their heap of challenges, hazards and everyday risks. It is expected that people are involved in the use of tools

and equipment be familiar with the risks associated with such occupation and take necessary precautions that would protect human lives and properties. Daryl (2016) described safety as the application of hazard control through the work place, person and system by integrating into the system sustained actions, and reducing risk to as low as reasonably possible to mitigate potential injury. This safety consciousness is expected to be possessed by electrical installation students in technical colleges. The importance of safety starts from school, during training and continues throughout a person's career. To be able to handle equipment successfully without any form of mishap, electrical installation students require a certain measure of safety skills. Skill could be seen as the ability to do something well. According to Aizikovitsh-Udi and Cheng (2015), skill is a well-established habit of doing something. Neitzel (2018) posited that a skilled electrician is not just someone who can perform any electrical job correctly but one who can complete every job safely. According to Dung (2015), safety has become a key determinant for effective and successful performance in a job. All of these point to the fact that safety skills are practical demonstration of capabilities. Safety skills could be a key criterion for the effective use of tools and machines in the workshop without causing imminent harm to their operators. These include preventive and responsive actions to emergencies that might occur before, during or after practice in the workshop. The college workshop is where students learn practical skills through their active involvement in workshop practice. The common safety skills knowledge needed by students in the college workshop include, and may not be limited to: correct selection and use of Personal Protection Equipment; hazard recognition; identification of Tag out equipment; inspection of tools and equipment before usage; emergency response and use of first aid equipment (Obed & Igharo, 2024). Also, Flagg and Amadi (2024), emphasizes that planned maintenance, which would include servicing before use, and early equipment management are key for workshop quality improvement and safety. Dung (2015) describes safety skills as the ability of electrical installation students to establish good habit performance in the workplace by acting, thinking, and behaving well to prevent minor and major accidents that can occur in any operation or job during electrical installation and maintenance works. This leads to improved workmanship.

Improved workmanship is the observable and sustained enhancement in the technical quality, consistency and problem-solving judgment of a person's craft or trade outputs that results from guided practice, workplace participation, and deliberate

refinement of technique. It combines embodied, tacit knowledge with explicit procedures and feedback, so that learners produce higher-quality, more reliable outcomes and adapt more quickly to task. Workplace learning and many years of situated practice create the tacit craft knowledge that results in improved workmanship. (Lensjø, 2024)

Workshop accident is an unexpected events that occur during the process of carrying out workshop practice. It could lead to injury or damage to tools and equipment. Therefore, the students need to be familiar with workshop safety skills for accident-free workshop practice. Workshop safety skills can be seen as the bedrock of modern educational practices needed to fit individuals into the work places (Bruce, 2015). The students are expected to learn in the college workshop how to use equipment including hand and power tools in carrying repairs, services of electrical appliances in preparation for the world of work. Jardine and Tsang (2021) described the equipment as a physical item or tool used to achieve a goal, especially if the item is not a consumable one in the process of installation. This implies that electrical equipment is a set of physical items or tools that can be used to achieve specific goals in the process of electrical works. Tools and equipment used in electrical workshop are classified into hand tools and power tools. Manually operated tools are called hand tools (Maidl, Herrenknecht & Wehrmeyer, 2021). Examples of electrical hand or manually operated electrical tools include but not limited to wrenches, axes, plier, side cutter, screw driver, hacksaw, spanner, pipe bending spring, cold chisel, hammer, trowel, and ladder. According to Houghton (2017), Power tools are tools that are actuated by an additional power source and mechanism other than the solely manual labor used with hand tools; they enable the operator to perform work more quickly and accurately". Power tools, unlike hand tools consists of moving parts such as a motor which converts electrical energy into power or other forms of useful energy. Power tools act either on electromagnetic or electrostatic principles, but not stationary apparatus such as transformers (Fotis, 2023). This indicates that machines are not static objects when at work. Examples of power tools used in the work shop for workshop practice are portable power drilling machine, portable power filling machine, signal generator, oscilloscope, soldering bit, heat blower, and mega tester, among others. The use of these tools in the college workshop could cause accident if the students fail to observe the safety precautions required to handle them effectively. Hence, the Canadian Centre for Occupational Health and Safety recommends that a power tool operator

should not set speeds, adjust, or measure work until the machine is completely stopped. (CCOHS, 2024)

Majority of injuries, hazards and accidents that occur during the use of hand and machines tools could be as a result of misuse and improper maintenance. Accident could occur if the students fail to: use the correct personal protection equipment, use lockout or tagout tool, inspect the tools before use, respond to emergency situation, communicate effectively and ignore fatigue condition. Although in some cases even when they are properly used or maintained, they seem hazardous to the operator by mere exposure. Another source of accident in the college workshop that students need to be conscious about is the workshop environment. The students are expected to know that poorly arranged workshop facilities could cause accident. For example, spaces between work benches, wrong placement of tools, particles of sharp objects on the floor, broken cables. Others workshop environmental conditions that could cause accident include poor ventilation, conditions of stools and chairs, noise, lighting system among others. Most of the tools and machines in the workshops are damaged due to poor knowledge of safety skills by students and instructors. Some of the machines are imported, expensive and not easily replaced. The continuous use of worn-out tools could increase the rate of accidents in the workshops. Ogunmilade (2024), strongly links unsafe workshop conditions with students' reluctance for practical participation. According to Ogunmilade, these unsafe workshop conditions are caused by use of wrong tools, worn-out equipment and poor safety rules, which contribute to an environment where students feel unsafe. It shows that even students are aware of the dangers of poor safety knowledge in their electrical workshops and the vulnerabilities of their exposure. Students and instructors need to pay attention to all the safety skills that are required by electrical installation students in handling equipment and workshop environmental conditions for improved workmanship.

1.1 Statement of the Problem

Accident is an unexpected event which normally results to negative consequences. Therefore, the need to prevent accident during our daily activities cannot be overemphasized. In the school workshop including electrical installation workshop, students are prone to injuries likely due to poor knowledge of the safety precautions needed to use hand and machine tools rightly. There are also reported cases of students who damage tools and equipment in the school workshop probably because they are not properly guided by the technical teachers. Common accidents in electrical

workshop include electrical shock, burnt, cut and bruises. Such accident could be minor or major injuries that could result to permanent deformation or death.

The worry in this case is that when such accident occurs, it could result to stoppage of workshop practice and some students could become scared of workshop practice. If students avoid workshop practice because of fear of injury, they might end up not acquiring the practical skills needed for employment and better workmanship needed for employment. This is what necessitated this study.

1.2 Purpose of the Study

The main purpose of this study was to ascertain the safety skills required by students of electrical installation and maintenance works. Specifically, the study determined:

- Workshop safety skills required by electrical installation students in handling hand tools.
- Workshop safety skills required by electrical installation students in handling machine tools.
- Workshop environmental conditions safety skills required by electrical installation students when working in the workshop.

1.3 Research Questions

To guide this study, the following research questions were raised and answered:

- What are the workshop safety skills required by electrical installation students in using hand tools in technical colleges?
- What are the workshop safety skills required by electrical installation students in using machine tools in technical colleges?
- What are the workshop environmental condition safety skills required by electrical installation students in technical colleges?

1.4 Hypothesis

One null hypothesis was formulated and tested at .05 level of significant:

There is no significant difference between the opinion of male and female technical teachers of the workshop safety skills required by electrical installation students in technical colleges in Edo State.

2. Research Methodology

The descriptive survey research design was adopted in this study. The population of the study was the entire 64 technical teachers currently servicing in the four Government Science and Technical Colleges offering electrical installation and maintenance works in Edo State. The entire population of 64 technical teacher made of 44 male and 20 female was used as the sample because it was manageable, hence a census. The instrument used for data collection was a questionnaire title “Workshop Safety Skills Required by Electrical Installation Students in Technical Colleges Questionnaire (WSSREISQ)”. The response items were based on a four-point modified likert scale of Highly Required, Required, Moderately Required and Not Required and were weighted 4, 3, 2 and 1 respectively. The instrument was validated by three experts, all from the Faculty of Vocational and

Technical Education, University of Benin. The reliability of the instrument was determined by test-retest technique. Pearson Product Moment Correlation Coefficient (PPMCC) was used to calculate the reliability value and it yielded 0.72. The instrument was administered to the respondents by the researcher and two research assistants who were briefed on the procedure adopted. The return rate of the completed questionnaire was 100%. Statistical Package for Social Sciences was used to analyze the data. Mean (x) and Standard Deviation (SD) were used to answer the research questions. The criterion mean was set at 2.50 such that any calculated mean value equal or greater than 2.50 was considered as required whereas mean value less than 2.50 was regarded as not required. The Z-test statistical tool was used to test the hypothesis at 0.05 level of significant. If the calculated Z-test value was less than the critical value of 1.96, the null hypothesis was retained.

3. Presentation Of Results

Research Question One: What are the workshop safety skills required by electrical installation Students in handling hand tools?

Table 1: Mean and Standard Deviation of Responses of the Safety Skills Required by Electrical Installation Students in Handling Hand Tools.

S/N	Safety skills required in handling hand tools in electrical installation	Mean (X)	SD	Decision
	Select right tools for the job	3.19	0.56	Required
	Use tools with a good handle always	3.45	0.48	Required
	Avoid using tools without handles	3.29	0.71	Required
	Check the sharpness of hacksaw blades, scribers, punch and screw drivers before use.	3.48	0.64	Required
	Use appropriate tools for a specific job or operation	3.43	0.62	Required
	Know the capacity of any tool before using it for any work.	3.67	0.52	Required
	Use insulated hand tools for electrical work	2.84	0.58	Required
	Put finger behind the tip of the screw driver while screwing	3.12	0.62	Required
	Use correct size of screw drivers for work.	3.25	0.57	Required
	Give a tool to colleague through the handle	3.72	0.62	Required
Grand Mean		3.34		

Researcher’s Field work, 2025 N = 64

The data in Table 1 showed that items 1 to10 had mean values ranging from 2.89 to 3.72. These values are greater than the criterion mean of 2.50. It indicates that all the ten workshop safety skills listed in the item statements are required by electrical installation students in handling hand tools in the college workshops.

Research Question Two: What are the safety skills required by electrical installation students in Handling machine tools?

Table 2: Means and Standard Deviations Responses of the Safety Skills Required by Electrical Installation Students in Handling machine Tools?

S/N	Machine Tools Skill Requirement	Mean	SD	Decision
	Protect hand switch gloves and wear safety shoes when Operating portable tools and machines.	3.29	0.74	Required
	Wear approved eye protect or when operating a power tool.	3.33	0.74	Required
	Stop power tools or machines before cleaning activities or making any adjustment	3.12	0.64	Required
	Switch off the socket outlet before connecting power tools or Machine.	3.32	0.86	Required
	Disconnect the power tools or machine immediately the work is done.	3.74	0.57	Required
	Disconnect the power tool o machine immediately a strange sound is noticed.	3.24	0.80	Required
	Remove the plug of the power tool or machine before Making any adjustment.	3.36	0.87	Required
	Keep the body away from the rotating part of the power tool/machine.	3.64	0.66	Required
	Never put the whole body weight on portable drill while drilling	3.54	0.73	Required
	Never adjust any power tool or machine while running	3.24	0.61	Required
	Check faults in the power tool or machines before re-use.	3.34	0.51	Required
	Use brush to remove chips from drilling machine.	3.24	0.43	Required
	Remove all hand tools from power tools or machine stable	3.16	0.49	Required
	Switch off the machine or power tool after use.	3.24	0.43	Required
	Remove power tools and machines from the power source after use.	3.58	0.49	Required
	Check and tighten drill bit before use.	3.64	0.51	Required
	Concentrate on work while using power tool or machine.	3.23	0.98	Required
	Keep fingers away from cutting edge of power tool or machine.	3.26	0.78	Required
	Maintain safety margin specified for a machine.	3.19	0.65	Required
	Use apron or over all while operating any power tool or machine.	3.28	0.48	Required
	Report to the instructor any strange noise from the Power tool or machine.	3.31	0.58	Required
	Stop operating power tool or machine if job is boring or You get tired.	3.53	0.74	Required
	Remove coat and jacket, tie and roll up loose sleeves Before operating any machine.	3.71	0.75	Required
	Turn off the power machine and wait until the motor stops.	3.24	0.87	Required
Grand Mean		3.36		

Researcher's Field work, 2025 N = 64

The data in Table 2 showed that items 1 to 24 had mean values ranging from 3.12 to 3.74, which were greater than the criterion mean of 2.50. It means that all the twenty-four workshop safety skills stated in the item statements are required by electrical installation in handling machine tools in the college workshops.

Research Question Three: What are the workshop environmental condition skills required by electrical installation students?

Table 3: Mean and Standard Deviation of Responses to the Workshop Environmental Condition Safety Skills Required by Electrical Installation Students in Technical colleges.

S/N	Workshop environmental Condition Safety Skills required by electrical installation students.	Mean	SD	Decision
	Keep gang ways clear and provide free access to every part of the workshop.	3.33	0.33	Required
	Remove all loose cables from the floor of the workshop.	3.83	0.83	Required
	Work in a very bright workshop.	3.67	0.67	Required
	Keep the floor off grease, oil or any liquid.	3.33	0.33	Required
	Remove all rings, brackets and similar metal item.	3.67	0.67	Required
	Wear hand gloves when working in the workshop.	3.01	0.54	Required
	Keep all tools in the workshop in their boxes.	3.23	0.64	Required
	Never throw any hand tool to colleague in the workshop.	3.57	0.67	Required
	Walk carefully in the workshop.	3.40	0.58	Required
	Make use of the recommended fire extinguisher in the workshop in case of fire outbreak.	3.51	0.64	Required
	Grand Mean	3.46		

Researcher's Field work, 2025 N=64

The data in Table 3 showed that items 1 to 10 had Mean values ranging from 3.01 to 3.83, which were greater than the criterion mean of 2.50. This indicates that all the ten workshop safety skills stated in the Table were required by electrical installation students for workshop safety.

Hypothesis

There is significant difference between the opinions of male and female technical teachers of the workshop safety skills required by electrical installation students in technical colleges in Edo State.

Table 4: Summary of Z-test Analysis of the Difference between the Opinions of Male and Female Technical Teachers of Workshop Safety Skills Required by Electrical Installation Students in Technical Colleges in Edo State.

Respondents	N	(\bar{X})	SD	Df	z-value	Critical-value	Remark
Male	44	2.66	0.72	62	0.21	1.96	Fail to Reject
Female	20	2.85	0.78				

Source: Researcher's Field Work, 2025

The data in Table 4 showed that the mean value of male technical teachers was 2.66 while that of female technical teachers was 2.85. With a degree of freedom of 62, the calculated z-value was 0.21 with a critical-value of 1.96. The z-value of 0.21 was less than the critical-value of 1.96. Therefore, the null hypothesis

which states that there is no significant difference between the opinions of male and female technical teachers of the workshop safety skills required by electrical installation students in technical colleges in Edo State failed to be rejected.

4. Discussion of Findings

The findings of this study revealed that electrical installation students require workshop safety skills in handling hand tools in the college workshop. Examples of such skill as avoiding using hand tools with broken handles and worn-out tools among others. It means that electrical installation students require all the safety skills listed to be able to work successfully. This finding agrees with Dung (2015) who observed that safety has become a key determinant for effective and successful performance in a job. All of these point to the fact that skills are practical demonstration of capabilities. The finding is also in consonant with the observation of Ogunmilade (2024) who stated that hand tools do not frequently cause accident provided they are in good working order, handled correctly, and kept safely. The findings also agreed with Flagg and Amadi (2024), who emphasized that planned maintenance, which includes servicing before use, and early equipment management are key for workshop quality improvement and safety. As a result, electrical installation students must use caution when doing any activity in the workshop.

The study's findings also revealed a wide range of safety abilities required for operating machine tools in electrical installations as identified in research question two. This finding agrees with the recommendation of the Canadian Centre for Occupational Health and Safety (CCOH,2024) that a power tool operators should not set speeds, adjust, or measure work until the machine is completely stopped. Therefore, it is critical that electrical installation students wear and use specific materials in order to play safely in the electrical installation workshop.

In research question three, it was revealed that electrical installation students require all the safety skills listed. This finding is in agreement with work of Obed and Igharo, (2024) who observed that there is need to observe certain safety rules during workshop activities including environmental safety, workshop maintenance and the use of Personal Protective Equipment. Such measure is able to prevent damages to workshop equipment and injury to workers. This implies that operator of machines and power equipment. If students cultivate the habit of using Personal Protective Equipment safety helmet, factory foot wears, nose mask, eye goggles, among others, accidents caused by the nature of workshop environment in the college workshop will be drastically reduced.

5. Conclusion

Effective teaching and learning in the college workshops including electrical installation workshop is strongly reliant on students and teachers' excellent health conditions. One major way of achieving this feat is prevention of accident through workshop safety consciousness. Workshop safety consciousness is able to make students develop confidence and acquire safety skills in handling hand and machine tools which will in turns improve their workman ship in the labour market. Therefore, this study established that electrical installation students in technical colleges in workshop safety skills and that such skills if acquired by students will enhance their workman ship thereby making them to be relevant in the world of works.

6. Recommendations

The following recommendations were made based on the findings of this study:

Since technical students highly required safety skills in handling hand tools, technical teachers should make them to be more conscious of the safety skills required to handle electrical installation hand and machine tools for accident-free workshop activities and improved workman.

Electrical installation students should be made to pay more attention to workshop environmental conditions such as proper ventilation, clean workshop floor, naked electric cables, excessive heat and noise that could cause accident in the college workshop. successful workshop practice should be made daily exercise for all electric\

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