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SKILLS REQUIRED BY ELECTRICAL INSTALLATION AND MAINTENANCE GRADUATES FOR EMPLOYMENT AND SELF -RELIANCE.

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Abstract

The development of skills, particularly in the electrical installation and maintenance trades, will undoubtedly result in the creation of jobs and a greater sense of self-reliance, as unemployment is a sign that technical college graduates lack marketable abilities. The goal of this study is to identify skills that Electrical Installation and Maintenance graduates need to make them employable and independent employers of labour. Planning the layout and installation of wiring, testing electrical work for safety and other tasks related to electrical installation and maintenance are some of the abilities identified. For the establishment of jobs, skills such as tool proficiency, efficient material use, electrical installation inspection, wiring diagram interpretation, and similar tasks are crucial. From the findings it is advised, that all specified talents identified be incorporated into technical institutes' curricula for student training. Also, governments at levels should finance and equip technical college workshops in order to train and equip students with the necessary skills for job creation and self-reliance after graduation.

Introduction:

Learning is the accumulation of knowledge, both theoretical and practical which is one of the objectives of education. According to the Federal Republic of Nigeria (2013), one of the goals of education is the acquisition of appropriate skills and development of mental, physical, and social abilities, competencies and as well as the preparation for the individual to live and contribute to the development of his society. In Nigeria, technical education is the program given the mandate to produce craftsman or middle-level manpower that will acquire practical skills in the utilization of technological devices through technical college (FRN, 2008).

In the same vein, Nwachukwu, Bakare, and Jika (2011) submit that technical college provides students through training with the relevant and adequate knowledge, skills, and attribute for employment under the guidelines of a teacher in related occupations. The place of skill

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acquisition in technical education can not be overemphasized and to achieve these objectives, too many trades are learned in technical colleges. Ede, Miller, and Bakare (2010) identified that students undertaking technical education programs are trained in auto-mechanics, woodwork, plumbing, computer craft, mechanical trades, radio, television (RTV) and electronics works, electrical installation, and maintenance work. With a focus on the electrical/electronic (E/E) trade, the Electrical/electronics trade is vital in the production of the workforce with an understanding of diverse skills in the design, development, production, management, and utilization of trending electrical/electronic devices and circuits. According to the Republic of South Africa (2008), electrical/electronic trade focuses on the application and understanding of principles and technological processes inherent in the application/production of electrical/electronic products and systems to improve the quality of life. Given the National Board for Technical Education programme (NBTE, 2012) electrical/electronics offers trade in;
Appliance maintenance and repairs, Electrical installation and maintenance works, Instrument mechanics, Radio, television (RTV), and maintenance work.

In light of the aforementioned, technical college programs that offer electrical installation and maintenance services equip students with the skills they need for employment and self-reliance. Electrical installation and maintenance work provide technical training to meet the demands of the electrical industry and the needs of the individual allowing the students to identify their career objectives (Ogwa 2016).

Skill is the capacity to do an action successfully. It takes training or experience to develop a skill. Skill acquisition in electrical installation and maintenance works employs measures and develops jobs in electrical installation geared towards making students confident and self-reliant (Ngwoke, 2006).

The goal of the electrical installation and maintenance works curriculum is to get students ready for entry-level knowledge and practical skills required for job in the electrical industry.
Students who undergo training in Electrical installation trades are expected to posses skills for excellence in installation of electrical machines and equipment, maintain nerve of machines and equipment, winding of electrical machines, testing and inspection of electrical installations, repair of electrical machine, etc.

According to https://safetyculture.com/topics/electricalmaintenance/, electrical installation and maintenance is the process of installing and maintaining electrical systems and equipment. It may include tasks such as installing wiring, repairing or replacing damaged equipment, and inspecting electrical systems for safety.

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With installation, correctly installing electrical systems is vital to ensure the safety of those working with or near the equipment and to prevent any damaging electrical fires.

Maintenance is equally important, as it helps to keep equipment running safely and efficiently. By inspecting electrical systems regularly and making any necessary repairs, potential electrical hazard can be addressed before they become more serious.

In view of the above, National Board for Technical Education (NBTE, 2004) maintained that electrical installation craftsmen are expected to test, diagnose, service, install and completely repair any fault on electrical machines and equipment using the manufacturer's manual. A well trained electrical installation and maintenance worker will be capable of designing, installing, repairing or maintaining electrical work systems in industries and residential buildings.

Ekwe (2009) opined that technical college students require competent hands, adequate facilities and practical work experience towards effective skills acquisition in electrical trades to strive towards job creation self-reliance and self dependent.

Self reliance is the capacity of being the boss of oneself which is as a result of saleable skills for proper adaptation to the world of work that would subsequently enhance poverty reduction. Ogwa (2015) noted that the objectives of electrical installation and maintenance is to train and impact needed skills to technical college students in that area to enable them to secure employment in a recognized organization, create a job or become self-reliant economically. The electrical installation trade also equips an individual with functional and saleable skills, knowledge, and attitude or value that would enable them to operate in rendering service in an electrical-related institution or work.

Electrical installation skills required for self-reliance and employment include:

1. Planning the layout and installation of wiring:

A graphic representation of the electrical wiring system is the electrical wiring layout plan. Lighting, fans, air conditioners, hot water geysers, refrigerators, space heaters, televisions, and other electrical devices plugged into the system are all included in the layout plan.

The electrical wire layout diagram aids interior decorators and architects in planning the lighting for various interior areas. Calculating the house's electricity demand precisely is also helpful.

Two steps can be used to organize the full electrical work project for the residence. The layout of the electric system must be planned first.

The actual wire work must then be carried out in accordance with the layout plan.

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The following steps make up the conventional procedure for planning the house's electrical wiring layout.

1. Determine the needs for the electrical outlets in each room.
2. Establish the rated capacity at each point in the room.
3. Determine the electrical load for every space.
4. Indicate where each room's electrical switchboard is located.
5. Set up several circuits to handle the total electric load.
6. Choose the electrical lines' rated capacity.
7. Establish the main electrical control panel's size.

2. Test electrical work for safety:

By following the right safety testing protocols, you can be sure that you're safeguarding both the projects you're working on and yourself.

Without proper electrical safety tests, a faulty wiring setup or an incomplete electrical system could lead to electric shock, fire, and other dangers caused by faulty equipment.

What are the Different Types of Tests Used?

The most common types of electrical safety checks include:

1. Insulation resistance tests (measuring the resistance between conductors)
2. Earth continuity tests (measuring the resistance between a conductor and ground)
3. Polarity checks (ensuring the correct phase rotation
4. RCD tests (testing residual current devices)
5. Visual inspections (checking for Ioose connections and worn insulation)
6. Functional tests (to check if a device works as expected)

Certain applications- or environment-specific tests may be added to these test processes, depending on how complicated the project is that you're testing. For all of your testing needs, a wide range of test and measurement equipment is available.

How to Perform Electrical Safety Test

When performing a safety test it is mandatory to take the following steps:

1. First, turn off all power sources connected to the device.
2. Disconnect any attached cables.
3. Check for any loose connections
4. Perform your test according to its requirements
5. Reattach all cables once finished
6. Turn the power back on and confirm results are accurate before using the device again

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3. Competency with tools: This is possessing adequate knowledge, skills, and abilities in making use of tools.

The following are practices that enhance competence :

1. Always wear eye protection.
2. Wear the RIGHT SAFETY EQUIPMENT for the job.
3. Use tools that are the RIGHT SIZE & RIGHT TYPE for your job.
4. Follow the correct procedure for using EVERY tool.
5. Keep your cutting tools SHARP and in good condition.
6. DON'T work with OILY or GREASY hands.
7. Handle SHARP-EDGED and POINTED TOOLS with care.
8. Always carry pointed tools with the points and heavy ends DOWN.
9. SECURE all small work and short work with a vise or clamp.
10. NEVER carry tools in your pockets.
11. DON'T use tools that are LOOSE or CRACKED.
12. KEEP your punches & chisels in good condition.
13. Mushroomed heads can chip & cause injuries.
14. DON'T use a file without a HANDLE.
15. Don't pry or hammer with a FILE. It may shatter.
16. Don't use screwdrivers as chisels or pry bars.
17. Don't try to increase your leverage by using a "cheater" with a wrench. Wrenches need the right strength for their size and length.
18. Use the RIGHT TYPE of tools for the job.
19. NEVER place tools and materials where they hang on the edge of a bench.
20. Don't use tools for jobs they aren't supposed to handle.

4. Interpretation of Wiring Drawings:

Several varieties of schematic symbols exist for representing real devices or wires in a circuit. The expertise to understand these electrical diagrams and be able to read them is key, as a wrong reading of these details results in a wrong interpretation. Wiring diagrams show how the wires are connected and where they should located in the actual device, as well as the physical connections between all the components. a wiring diagram uses abstract or simplified shapes and lines to show components.

For example, a switch will be a break in the line with a line at an angle to the wire, much like a light switch you can flip on and off. A resistor will be represented with a series of squiggles symbolizing the restriction of current flow. Straight lines represent wires, the wires are used to connect different peripherals in a circuit. This may include bulbs, switches, etc. A triangle

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represents ground or service, it indicates the area of operation for a circuit. A zigzag diagram represents resistors.

5. **Compliance with Statutory or Safety regulations:**

Statutory regulations are fixed and mandatory requirements that
Must be complied with electrical installation work. These regulations are done by law and are enforced by various regulatory authorities like AEDC,NERC, and Ministry of power. Example of statutory regulations Include factory acts penal codes.

Safety compliance is defined as an ongoing process of complying with the health and safety standards established by regulatory legislators and bodies. Depending on the industry or the nature of work, there are likely to be strict safety regulations that may apply to the industry or the jurisdiction.

In most situations, failure to comply with health and safety laws can result in criminal proceedings or hefty fines for employers. It is the employer's responsibility to enforce safety compliance in the workplace and to foster a safety culture.

Electrical Maintenance Skills Required by Technical Graduates for Employment and Self-reliance.

Electrical Maintenance skills required for self-reliance and employment include :

1. Forecasting of Spare Parts: Forecasting is an essential skill on predicting future events and represents a foundation for every valid assessment. Although forecasts are often deemed expensive and time consuming. The following steps can be used to forecast spare parts;

1. Understand your equipment lifecycle: The first step to forecasting spare parts is to understand the lifecycle of your equipment. Different types of equipment have different lifespans, usage patterns, and failure rates. You need to know how long your equipment is expected to last, how often it needs maintenance, and what are the most common and critical components that need to be replaced. You can use historical data, manufacturer recommendations, and industry standards to estimate these factors.
2. Use forecasting models and tools: The next step is to use forecasting models and tools to predict the future demand for spare parts. There are various methods and software available to help you with this task, such as time series analysis, regression analysis, and artificial intelligence. These methods use data from past demand, equipment condition, environmental factors, and customer behavior to generate forecasts.
3. Implement inventory management practices: The third step is to implement inventory management practices to optimize your spare parts inventory. You need to balance the

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trade-off between having enough spare parts to meet your service needs and minimizing the risk of obsolescence.

4. Adopt proactive obsolescence management strategies: The fourth step is to adopt proactive obsolescence management strategies to prevent or mitigate the impact of obsolescence. You can do this by staying updated with the latest technology trends, product changes, and market developments that may affect your spare parts availability and compatibility.
5. Evaluate and improve your performance: The final step is to evaluate and improve your performance in forecasting spare parts demand and avoiding obsolescence. You should measure and track your key performance indicators (KPls) such as forecast accuracy, service level, inventory turnover, obsolescence rate, and customer satisfaction.

2. Root cause analysis: This is a critical technique in maintenance management, focusing on identifying the primary causes of problems rather than just addressing their symptoms. In the realm of maintenance, this approach is essential because it helps pinpoint the exact reasons ' equipment fails, or performance arise.

By understanding these root causes, organizations can implement more effective and long-lasting solutions. This method is not just about fixing problems as they occur; it's about digging deeper to understand why these issues happened in the first place, which is crucial for preventing them from recurring.

The main objective here is to prevent future occurrences of the same problems. It involves a thorough investigation of the incidents to uncover the underlying issues. This process is vital in maintenance management as it leads to more reliable operations, reduces downtime, and saves costs in the long run. By effectively identifying and addressing the root causes, maintenance teams can enhance the efficiency and longevity of their equipment, ensuring smoother and more predictable operations. It is about learning from past issues to create a more robust and efficient maintenance system.

In root cause analysis, several tools are commonly used to identify and solve underlying problems in maintenance management. These include; the Fishbone Diagram, also known as the Ishikawa Diagram, which helps map out various potential causes of a problem in a structured way; Fault Tree Analysis (FTA), a method that uses a tree-like model to break down the causes of an issue; and Failure Modes and Effects Analysis (FMEA), which anticipates potential failures in a process and their effects. Each tool offers a unique approach to uncovering the root causes of problems, enabling maintenance teams to apply targeted solutions that prevent future issues and improve overall operational efficiency.

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3. Estimation of maintenance cost: If you are trying to calculate the cost of maintaining a particular asset, you should include the prices with energy (for example, how much energy do you spend to keep the escalators running?) and the cost of other expenses necessary to operate the equipment (for example, cost of insurance, mandatory inspection, etc.). This is known as "cost of ownership", which follows the formula below:

Cost of labour + Cost of materials + Suppliers (outsourcing) + Energy + Other Expenses.
With a maintenance management software, it is much easier to estimate each of these costs:\

A. labour cost: calculate the number of maintenance hours based on technicians' logs (make sure they always open and close work orders when starting and finishing, and that the meter is not left running!). Then multiply by the hourly wages of the technicians.

B. price of parts and materials: organize your inventory in the maintenance software so that you know how many materials and parts you have used for a particular asset (for example, for an air conditioner: price of filters, tablets for the condensate tray, etc.).

C. other invoices: includes all other expenses, namely with suppliers (maintenance contracts) and outsourcing (e.g., hiring an F-gas technician).

4. Evaluation of alternatives: This is the operational effectiveness, cost, and risks of proposed materiel solutions to gaps and shortfalls in operational capability.
The effectiveness of an alternative is the degree to which that alternative is perceived as satisfying identified objectives. It is necessary to evaluate alternatives in the following areas :

A. People: When evaluating alternatives it's important to consider how the different options will impact the workforce. This may involve assessing the skills and training required for each method, as well as considering the potential impact on employee safety, morale, and productivity.

B. Plant, equipment or machinery: Evaluating alternatives involves assessing the compatibility of different options with existing equipment and machinery. This could also involve considering the cost and feasibility of upgrading or replacing equipment to accommodate the new methods. Feasibility of upgrading or replacing equipment to accommodate the new methods.

C. Materials and components: When evaluating alternatives, it's important to consider the availabiquality, cost, and quality of materials and components required. This may involve comparing different sourcing options and assessing the potential impact on product quality and production efficiency.

D. Work area and facilities: When evaluating alternatives it's important to consider the physical space and facilities required for each option. This may involve assessing the

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layout, capacity, and suitability of the work area, as well as considering the potential need for modifications or upgrades.

CONCLUSION

It can be concluded that graduates of electrical installation require the following skills for employment and self reliance: Planning the layout and installation of wiring, test electrical work for safety, competency with tools, interpretation of wiring drawings, compliance with statutory or safety regulations. Also, it can be concluded that maintenance graduates require the following skills for employment and self reliance: Forecasting of spare parts, root cause analysis, estimation of maintenance cost, evaluation of alternatives.

RECOMMENDATION

Based on the findings, the following recommendations are provided :

1.Emphasis should be given on industrial modulation module because of its wide application to the graduates of electrical installation and maintenance graduates.

2.On the job training should be provided by work place based supervisors to remedy the very low skills acquired by Electrical installation and maintenance graduates in some task clusters in industrial installation module.

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