MAINTENANCE PRACTICES OF INSTRUCTORS IN ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORIES AND WORKSHOP IN POLYTECHNICS IN NIGER STATE, NIGERIA

BY

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2015/3/57485TI

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

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A RESEARCH WORK SUBMITED TO THE DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF TECHNOLOGY DEGREE (B.TECH) IN INDUSTRIAL AND TECHNOLOGY EDUCATION

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DECLARATION

I, **AGBOLADE AYANWALE** with matriculation number **2015/3/57485TI,** an undergraduate student of the department of industrial and technology education certify that the work embodied in this project is original and not been submitted in part or full for any diploma or degree or any other university.

_____ _____

Name and Matric No Sign and Date

CERTIFICATION

This project has been read and approved as meeting the requirements for the award of B.Tech degree in Industrial and Technology education, School of Science and technology, Federal University of technology, Minna.

_____	_____
Project Supervisor	Sign and Date
_____	_____
Head of Department	Sign and Date
_____	_____
External Examiner	Sign and Date

DEDICATION

This project work is first and foremost dedicated to God Almighty for his grace, mercy and strength bestowed on me throughout this work

The work is also dedicated to my parent Mr. and Mrs. Agbolade my sibling(s) Ayanleye, Ayankunle, Ayanjoke and Ayanbadejo.

Am also dedicating the project work to my project supervisor for his words of encouragement, advice, correction and time towards making this research project a success, I say may God bless you sir.

I also dedicate the work to my aunties, uncles, cousins whose name cannot be mentioned because of time. I say thank you for your kind support morally, financially and other wise towards the completion of this work I say God bless you all and your families Amen

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ABSTRACT

This research work was carried out to determine the maintenance practices of instructors in electrical and electronics engineering laboratories and workshop in polytechnics in Niger State. The case study was done with a target population of the two polytechnics in Niger State. Three research questions and three hypotheses were formulated and tested at 0.05 level of significance. The research work is a descriptive survey: a well-structured questionnaire was developed by the researcher and used for data collection. The study was carried out in Federal Polytechnic Bida and Niger State Polytechnic Zungeru in Niger State. The numbers of respondents were thirty-five (35) being made up of twenty (25) lecturers and ten (10) workshop and laboratories instructors in the Electrical and Electronics Engineering department of the institution. This number was used as population for the study. The data collected was evaluated using mean, standard deviation and t-test to test the three hypotheses. The findings revealed that both the lecturers and instructors very highly adopts the three maintenance practices as stated in the research questions. It was recommended that government should give special consideration to the management of our laboratories and workshops in all the tertiary institutions in the country

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of Study

Polytechnic education in Nigeria is one out of the three arms of tertiary education in Nigeria. It is an institution of higher education offering courses Such as electrical and electronics engineering, mechanical engineering building engineering, chemical engineering and so forth at degree level or below, especially in vocational and technical subjects. The polytechnic education is charged with the primary responsibility of producing the technical manpower needed for industrial growth in Nigeria. This is a responsibility the polytechnics discharges alongside with Universities of Technology in Nigeria. It offer courses (programmes) in various fields of Technology and Applied Sciences leading to the award of National Diploma (ND) Certificate for the first two years of study and a Higher National Diploma (HND) Certificate for the second phase of the four year programme in the polytechnic. In each phase (that is, The National Diploma or Higher National Diploma) the students Polytechnic trained graduates are expected by virtue of their training to be more practical oriented. According to Stuliff (2012), industrial exposure gives the academics a chance to seek inputs and feedback from practicing professionals who can provide valuable insight into the skills and abilities students would need in their career. Ballinger and Lalwani (2010) also indicated that it offers an opportunity for students to personally practice the theoretical models in the classroom to enhance their chances of securing employment after graduation. They are to serve the middle-level manpower management needs of the country in the drive towards industrialization.

The main objective of polytechnic education is the promotion of technical and vocational education and training, technology transfer as well as skills development to enhance the socio - economic development of the country. Polytechnic education plays a vital role in human resource development of a country by creating skilled manpower, enhancing industrial productivity and improving the quality of life.

Electrical and electronics engineering is one of the major options or special areas offered in Nigerian polytechnics under the department of technology and vocational education. However, the teaching and learning of electrical/electronic engineering specialized area as a field of study in technology education is vital in the production of workforce with potent understanding and diverse skills in the design, development, production, management and utilization of current electrical and electronics devices and circuits.

According to Caribbean (2011), Electrical and electronics engineering is a field of study that provides both theoretical and hands-on knowledge of current electrical and electronics devices and circuits. Hence, Electrical and Electronics Technology (EET) education syllabus is designed to provide the essential fundamental knowledge and the analytical, practical and experimental skills necessary for a lifelong career in the field of electrical and electronics technology. It also provides students with fundamental knowledge and skills for the workplace and professional teaching skills in electrical and electronics field. For effective teaching and learning of electrical and electronics technology education, instructional materials and facilities are necessary. Instructional materials and facilities on their own help to facilitate teaching and learning and are used to influence concrete and permanent change in technical behaviour. According to Eya (2014) instructional materials are all forms of information carriers which can be used to

record, store, preserve, transmit, concretize or retrieve information for the purpose of teaching and learning.

Workshop Instructors are person who serves as a coach and as a guide to the leaners on the practical aspects of all they have learnt theoretically. He gives instruction to learners on how to go about a practical activity in the workshop. Meanwhile for effective use of these instructional materials, electrical and electronics workshop instructors must be up to date in their maintenance practices. Maintenance practices are "the combination of all technical and associated administrative actions intended to retain an item in, or restore it to, a state in which it can perform its required function. It includes inspection, testing, servicing, repair and reclamation. In sum maintenance encompasses all works carried out on a plant or a facility with the view of rectifying a defect or failure in its functioning or performance; preventing failure in its functioning and/or improving the state of the facility so as to sustain its utilization and value. In a production facility, maintenance acts as a support for the production process, where the production input is converted into specified production output. Industrial maintenance comes as a secondary process, which has to contribute for obtaining the objectives of production. Maintenance must be able to retain or restore the systems for carrying out a perfect production function. (Gits,2010). There are great arrays of maintenance strategies available in order to design the optimal maintenance program. This includes:

Preventative maintenance (PM) can be described as a fixed time maintenance task scheduled in order to detect or prevent failures before they happen. This is the most Common approach to maintenance and usually aligns with the equipment Manufacturer recommendations. As equipment can be used in many different applications it is always

beneficial to challenge the current preventive maintenance program frequencies, as equipment history is built there is an opportunity to remove non-value adding tasks.

Greg *et al* (2006), highlighted the importance of an effective preventive maintenance program within manufacturing strategies such as Just in Time (JIT) where optimal stock buffers in the production process are setup; preventive maintenance is included in this buffer and allows the equipment to be maintained without holding up the entire process. As more and more companies are now moving towards Lean Manufacturing in which waste in every aspect of the production process is eliminated, preventative maintenance may not be enough on its own and more emphasis is moving towards on-line condition based monitoring which is non-intrusive and can detect potential failures well in advance. This „waste" term referred to in Lean Manufacturing is not the conventional meaning of the word but rather anything that is non-value adding in the production process, waste could be seen as equipment breakdown which can cause unnecessary delays in production.

Predictive Maintenance or conditional based monitoring is an emerging scientific technology that can be employed to detect potential failures that may not be evident even through a preventive maintenance program. If the failure characteristics of the equipment are known then condition based monitoring can detect the failure well in advance and appropriate actions can be taken in a planned manner. The use of predictive maintenance has dramatically reduced non value adding maintenance by eliminating the need to unnecessarily shutdown equipment for maintenance checks.

Condition based monitoring is a relatively new Science and has huge benefits in Industry, however from the authors experience the tendency can be to sometimes have too much reliance on these technologies. Condition based monitoring will give

maintenance ample warning of a failure but may take the focus away from the actual root cause of the failure. (Mather, 2007), opinion is that for a truly effective predictive maintenance program an optimum cost should be spent on condition based monitoring based on risk, but also it should only be used a first step into determining why the equipment being monitored is starting to fail and what are the possible contributions. This is where the experienced maintenance professionals are still an important part of the maintenance process.

The corrective maintenance approach is a type of maintenance that is carried out to tackle problems that occurs unexpectedly or has been picked up in the field. Corrective Maintenance is often referred to as firefighting however not all corrective maintenance is a bad thing. If a good preventive maintenance program has been setup then big problems that are captured will be completed as corrective maintenance. However, the important difference between PM and CM is that PM is a fixed planned schedule CM is not, this can lead to unexpected costs within the maintenance department. The aim is to have the PM program high and the amount of CM low.

These case study focuses on the “Maintenance Practices” necessary for the instructors to keep equipment operating at peak reliability and functioning more profitably through reduced maintenance costs and increased productivity.

1.2 Statement of the Problem

In electrical and electronics workshop in polytechnics or industries machines and equipment are prone to break down as a result of poor maintenance practices. For these maintenance practices to be carried out effectively, electrical and electronics teachers, and instructors must possess high maintenance practice skills in order to prevent or

totally eliminate the occurrence of machines and equipment breakdown which will result to high spending.

However, the ideal ways of maintaining equipment and machines in electrical and electronics laboratory and workshop includes preventive, predictive and corrective maintenance. Preventive maintenance is a planned or schedule maintenance that is done on the onset of failure to prevent or delay breakdowns and to minimize the impact of a breakdown (Wild, 2002). This maintenance management practice is based on the principle that prevention is better than cure. Predictive maintenance on the other hand is based on sensing that equipment is going to give trouble e.g. if noise and vibrations have increased and thus prior arrangements for repairs are done. While corrective maintenance is carried out to tackle problems that occurs unexpectedly.

The maintenance practices that a firm adopts, impact heavily on its operational performance (Gupta & Marquez, 2006). A firm must hence adopt practices which offer it operational success (Campbell, 2005). It is evident that the current state of maintenance of equipment in electrical and electronics laboratory adopted by instructors is the preventive maintenance practice. This is due to the fact that the instructors lack sufficient maintenance skill to carry out their duties effectively.

The above issue has led to questions as to how do the maintenance management practices and level of management support impact on the firm's operational performance despite the challenges that are encountered? It is against this issue that the researcher tends to investigate the maintenance practices of instructors in electrical and electronics workshop and laboratory in polytechnics in Niger State.

1.3 Purpose of the Study

The aim of this study is to analyze the maintenance practices of instructors in electrical and electronics engineering workshop and laboratory in Polytechnics in Niger State. In order to achieve this aim, specific objectives were raised for the study; among which are to:

i. Identify the preventive maintenance practices in electrical and electronics Workshop in polytechnics Niger state.
ii. Identify the predictive maintenance practices in electrical and electronics Workshop in polytechnics Niger state.
iii. Identify the corrective maintenance practices in electrical and electronics Workshop in polytechnics Niger state.

1.4 Significance of the Study

It is expected that at successful completion of this study, students, lecturers, instructors, technical educators, ministry of science and technology, policy makers and the polytechnic management themselves will benefit from the findings.

The findings of this study if implemented will be of benefit to students. It will help students to acquire the necessary maintenance practices skills that are required in electrical and electronics workshop for effective operations.

The study will increase the knowledge and understanding of the students on maintenance education if the identified skills are used to train them.

The findings of this study will provide information to electrical electronics instructors on the maintenance practices skills required by them. The identified maintenance

practice skills could be used by these instructors to train their students in the workshops thereby reduce unnecessary teaching stress. The instructors will benefit from this study since the information gathered will create awareness for them on the maintenance practice skills and also help them to attend re-training programmes on maintenance practice education for improvement and efficiency in the Electrical and electronics workshop.

The findings of the study will be of benefit to the society as it will provide polytechnic graduate who are self-reliant and have the vocational, entrepreneurial, technological skill and manpower to drive the society.

The findings will be of great to the polytechnic management as they will get to gauge their performance in terms of maintenance culture against that of other polytechnics. They will get to know their weakness as far as maintenance is concerned and have determined action plan for improvement.

The polytechnic management will benefit from this research work as it will charge them with the responsibility of managing maintenance in their Organisation. It will also help them to determine where they need to change strategy so as to improve maintenance activities.

Polytechnic graduates if implemented. There will be enough polytechnic graduates who are conscious of maintenance practices to be employed by the industries and employers.

The findings provided will enable them to have competent employees from these polytechnics as craftsmen without wasting their resources in training them on maintenance education after employment.

National Board for Technical Education will find the results of the study relevant especially in planning by integrating the identified strategies into their curriculum so that teachers will find them helpful during delivery of instruction.

1.5 Scope of the Study

The research work is strictly concern with the analysis of maintenance practices of instructors in electrical and electronics engineering workshop and laboratory in Polytechnic Niger state. It also addressed itself to the identification of the best practices, the problems associated with poor maintenance strategies and the possible way forward. Also, the research work is also limited to Electrical and Electronics engineering Department of Polytechnics in Niger State.

1.6 Research Questions

The following questions were generated to answer and test the hypothesis in line with the objectives specified above.

i. What are the various preventive maintenance practices in electrical and electronics workshop?
ii. What are the predictive maintenance practices in electrical and electronics workshop in polytechnics?
iii. What are the corrective maintenance practices in electrical and electronics workshop in polytechnics?

1.7 Research Hypotheses

The following research hypotheses were raised and tested at 0.05 level of significance:

H_{01}: There is no significant difference between the mean responses of polytechnic instructors in workshop and laboratories on preventive maintenance practices in electrical and electronics engineering workshop.

H_{02}: There is no significant difference between the mean responses of polytechnic instructors in workshop and laboratories on predictive maintenance practices in electrical and electronics engineering workshop.

H_{03}: There is no significant difference between the mean responses of polytechnic instructors in workshop and laboratories on corrective maintenance practices in electrical and electronics engineering workshop.

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter reviewed related literature under the following headings:

i. Theoretical framework

ii. Polytechnic education in Nigeria

iii. Electrical and electronics engineering technology

iv. Maintenance practices

v. Review of related empirical studies

vi. Summary of literature reviewed

2.1 Theoretical Framework

Theoretical framework for the study is based on management theories and vocational education theories. In management theories, Scientific Management Theory will be used for the study, while in vocational education theories, The Process Habit Theory will be used for the study.

Theory is a general explanation of natural events which will better, explain as a set of tested common sense values or principles which help managers to understand, interpret or predict real actions (Ogbonna, 2003). In schools management, theories are used to back up management actions in educational practices. It influences the educational practices when properly applied.

The scientific theory of management

The scientific theory of management states that the overall output of a worker can be increased and improve upon through a scientific management process. The theory was propounded by Fredrick Winslow Taylor in (2012).

According to his philosophy of man as machine the regular jobs of an employee should be clearly defined by the employer for optimal utility. However, materials, tools and equipment that are required for successful execution of the defined tasks must be made available to the workers to enable them accomplish set standards of performance. Thus workers should be exposed to training relevant to their assigned tasks.

The theory relates to the present study in the sense that materials, tools and equipment must be made available to workers and also assigned task. Therefore, if electrical and electronics workshops and laboratories instructors are provided with materials, tools and, equipment relevant to their work, they will improve on their maintenance practices.

The Process Habit Theory

(Prosser C. 2011), propounded the process habit theory which states that effective vocational training can be given where the training jobs are carried on in the same way, with the same operations, the same tools and the same machines as in the occupation itself. This implies that for the leaner to be effectively prepared, he/she must be trained to possess the habit of doing each task or job in the way with the same tools, machines and operation as in the occupation itself. The functionality of these tools and machines in order to be used in preparing students is hinged on the proper management and maintenance.

The theory relate to the present study in the sense that it talk about proper management and maintenance of tools and machines for training the students. Therefore, in electrical and electronics workshops and laboratories, if this is done, instructors will improve on their maintenance practices.

2.2 Conceptual Framework

2.2.1 Polytechnic Education in Nigeria

Polytechnic Education in Nigeria evolved in response to technical and industrial needs of the people. It is the training of technically oriented personnel who are to be initiators, facilitators and implementers of technological development of a Nation by adequately training its citizenry on the need to be technically literate, leading to self-reliance and compelling sustainability. Polytechnic Education has more direct impact on national welfare and their contributions are widespread and visible ranging from metalwork technology, mechanical/automobile technology, electrical and electronics technology, building and woodwork technology.

Polytechnic education is multifaceted, multi-disciplinary and a pragmatic field, which is aimed at equipping the individual with requisite vocational and functional technical education. Literacy skills will enhance their relevance and functionality in the society. As a result it plays a vital and indispensable role in the development of the society (Uwaifo, 2008).

Victor (2009) saw Polytechnic education as a planned programme of courses that begins with an exploration of career options, support of basic academic and life skills, and achievement of higher academic standards, leadership, preparation for industry defined work and advanced continuing education. Polytechnic Education prepares learners on

careers that are based on manual or practical activities, traditionally non-academic and totally related to a specific trade, occupation or vocation.

It is an education that is designed to develop occupational skills to live and work as a productive citizen in any community and across the new ubiquitous competitive global village we have found ourselves as citizens of a new world order.

Polytechnic Education has been an integral part of National development strategies in most societies because of its impact on human resource development, productivity, economic growth and the human well-being as well as the general contribution to easing where and how we live as individuals and as a community of civilized citizens of Nigeria.

According to Ibenneme (2009), Nigeria does not seem to accord polytechnic and technical education the attention it deserves despite its proven consideration in other nations. However, the federal government of Nigeria had further demonstrated the importance of polytechnic/technical education and has taken a bold step towards filling the gaps in the local content Act, by giving scholarship to ex-militant youths within and outside the shores of Nigeria. They are being trained as technicians and technologists to make sure that most of the skilled, semi-skilled personnel and fabricated machines are reproduced from within Nigeria. These objectives among others if achieved should help Nigeria towards a more favorable balance of payments. The old system was designed to service the formal sector particularly the mines and organizations that serviced the mines which were at the start of the reforms non-functional. The mines had become less productive and the products of their training could not find jobs. With a formal sector that had become less productive, government revenue nosedived and plummeted.

Funds to equip the polytechnic education and also rehabilitate existing infrastructures became a major challenge. With few people accessing training and fewer people getting jobs, government saw the need to develop a training policy that made training accessible to all. The policy provided training that was responsive to the needs of the individuals, organization and the country at large. Hence the governments' urge to fund and carter for polytechnic education became most privatized in her annual budgeting and planning. The Polytechnic Education also aims at training students in the application of scientific knowledge to solving practical problems facing society, and not merely to train them in manual and technical education. In addition, the polytechnic education is seen as education for self- reliance, which leads to national development. It is the right which provides the persons that have received it with self-employment thereby contributing to the society in which he/she live. It is for this reason that Toby (1997), Sofolahan (1989), Fafunwa (1991), attributed under development to the current level of the Nation's technology which marks the socio-cultural difference between developed and developing worlds.

The Polytechnic education according to Nigerian Education Research and Development Council (NERDC) (1998) outlined the following as the major aims of PTE education:

(a) Providing trained manpower in the applied sciences and business, particularly at craft, advanced and technical levels.

(b) Providing the technical knowledge and vocational skills necessary for agriculture, commercial and economic development.

(c) Giving the necessary training and imparting skills to individuals who shall become self-reliant.

NERDC posited that in order to achieve unparalleled result in this domain the main features of the curriculum activities of polytechnic education shall be structured in foundation and trade modules and that the curriculum for each trade shall consists of four components namely; General education, theory and related courses; workshop practices, industrial training and small business management and entrepreneurial training. Benefits of Polytechnic Education to the Development of Nigeria include;

(a) It provides students with "life skills' to become productive entrepreneurs as it engenders creative and innovative ideas enlarges the economic pie and increases personal freedom. Most of the so-called 'expatriate engineers" who are being paid millions of dollars to build Nigeria's roads and bridges are graduates of polytechnic. Yet our leaders do not take Polytechnic education institutions seriously.

(b) Empowering the people with technical skills would enhance their productivity and national development.

(c) Getting students motivated to learn the art of vocational and technical education in the most efficient and economical manner possible.

(d) Teaching the skill of sound citizenship, in the art of vocational education.

(e) Polytechnic graduates are most likely to be employed and earn more than their non-vocational counterparts, being practical oriented, they have the capacity to work part time even while still at high school. There is strong evidence that the generic technical skills and the occupational specific skills provided in polytechnic education will increase workers' productivity, skills transfer, job access and job stability when her graduates find training related jobs.

(f) Educating beneficiaries/graduates for life.

(g) Practical skills; one of the advantages of polytechnic education is that it focuses on practical skills that students can put to use in a job immediately. Technical training

programs typically focus on teaching students how to perform the task that would be required from them in the workforce in various fields such as auto maintenance, carpentry etc.

(h) It can prepare students to enter into the workforce more quickly than in any other academic program.

(i) Marketable job skills; graduates of polytechnic are equipped to enter the job market armed with marketable career skills. These skills can lead to higher paying jobs and greater satisfaction.

The challenges and constrains militating against the polytechnics Education in Nigeria are many but few of the major ones are highlighted below:

1. Inadequate supply of technical workshops: most polytechnics institution lack functional workshops for effective inculcation of technical skills in students. This affects the effectiveness of polytechnic education.

2. Lack of sufficient fund: government funding of polytechnic education programs has not been impressive as this is a reflection of the nonchalant attitude of government towards the program. Most equipment, workshops, necessary technical/engineering books etc. are not provided.

3. Lack of adequate motivation: polytechnics teachers are subjected to deplorable working conditions. Offices are not furnished and working environments are not conducive for technical learning situations.

4. Lack of well-equipped libraries for research work/project: libraries are not well stocked with up-to-date technical books and periodicals in various areas of specialization.

5. Failed curriculum: the current curriculum of the National Board for Technical Education (NBTE) should be a total departure from the former imposed and imported

British one which did not tailor Nigerian curriculum towards technical skills acquisition.

6. Lack of information communication technology equipment: ICT and technical skills acquisition work simultaneously. Therefore, polytechnic institution should be equipped with contemporary ICT equipment in order to promote human resource development.

7. Political situation: Polytechnic education has been grossly neglected in Nigeria. Technical educators have the greatest challenges in convincing the law makers on why they should give priority to polytechnic education in allocating resource to it. The government keeps paying lip service towards the proper development of the program in Nigeria. It should be made clear here that until they begin to change their attitude towards the polytechnic education program, Nigeria will ever remain a technologically backward and dependent nation

2.2.2 Electrical and Electronics Engineering Technology

Electrical and electronics engineering technology is one of the major options or special areas offered in Nigerian polytechnics and universities under the department of technology and vocational education. However, the teaching and learning of electrical/electronic engineering technology specialized area as a field of study in technology education is vital in the production of workforce with potent understanding and diverse skills in the design, development, production, management and utilization of current electrical and electronics devices and circuits.

According to Carribbean (2001), Electrical and Electronics Technology is a field of study that provides both theoretical and hands-on knowledge of current electrical and electronics devices and circuits. Hence, Electrical and Electronics Technology (EET) education syllabus is designed to provide the essential fundamental knowledge and the

analytical, practical and experimental skills necessary for a lifelong career in the field of electrical and electronics technology. It also provides students with fundamental knowledge and skills for the workplace and professional pedagogy skills in electrical and electronics field.

Electrical and electronics engineering technology deals with the design, application, installation, manufacturing, operation or maintenance of all systems that uses electrical energy to function. However, electrical and electronics technology is a specialized discipline that has more focus on application, theory, and applied design, and implementation. Electrical and electronics engineering technology is the largest branch of engineering technology and includes a diverse range of sub-disciplines, such as applied design, electronics, embedded systems, control systems, instrumentation, telecommunications, and power system.

Marts (2010) observed that Electrical and Electronics is a fascinating subject and students easily develop interest when they are properly guided. It is therefore the duty of the lecturers and instructors in polytechnics to guide Electrical and Electronics engineering students in the process that will enable them to acquire the needed skills.

The purpose of the Electronic and Electrical Engineering Technology programs is to develop, in each student, the degree of technical competence that would allow the graduate to be employed as an Electronic or Electrical Engineering Technician in any engineering company. The educational objectives are the following:

1. Mechanical Ability: The ability to relate to various systems and design processes in the engineering/architectural/construction/surveying environment is the desired outcome. Developing, analyzing, and visualizing various types of materials, engineering drawings and specifications are required activities. Mechanical ability is developed by

Technical Specialty Courses and Basic Sciences.

2. Accuracy: The ability to solve problems properly and systematically is the desired outcome. An understanding of mathematics and the design process is required. Accuracy is developed by Basic Sciences and Basic specialty Courses.

3. Manual Dexterity: The ability to use a wide variety of equipment ranging from Computer programs such as AutoCAD, Computer simulation such as Electronic Workbench Multisim to sophisticated Function Generators, Oscilloscopes, and Millimeters' comparable to those used by technicians in industry. A respect for the proper care and maintenance of equipment is also developed. Manual dexterity is developed by Technical Specialty Courses, specifically lab-oriented courses.

4. Creativity and Confidence: The ability to develop and communicate one's own designs and engineering principles in various forms is the desired outcome. The variety of design courses allows for independent student solutions to various engineering/architectural/ construction/surveying problems proposed to the students. Creativity is developed by Technical Specialty Courses.

5. Effective Communication: The ability to communicate engineering and design information and concepts by oral presentation or in technical reports, in a manner that would gain approval and support, is the desired outcome. Another desired outcome is the attainment of proper social adjustment, which requires positive interaction among colleagues and customers. Confidence is developed by Humanities Courses, Communication Courses, and Technical Specialty Courses.

6. Technical Currency: The ability of present and past students to attain a technically current education is the desired outcome. An understanding of new equipment, methods of design, code modifications, and the impact of the computer on the technology are required. Technical currency is developed by Technical Specialty Courses and Basic Sciences.

2.3.0 Maintenance Practices

Maintenance is considered to be one of the key factors that secure the sustainability of any organization; combining maintenance with good operational practices will reduce the need for emergency maintenance and prevent the whole system from sudden breakdown, today, maintenance is not treated as a strategic business function. Over the last decade, however, it has been clearly shown that maintenance has tremendous impact on a company's profitability (Reh 2011). Maintenance can be defined as a combination of any actions carried out to retain an item in, or restore it to an acceptable condition (Terry 2011).

In other words one can say that the maintenance is major function that assures all facility (manufacturing/service) and equipment in adequately operation to avoid or to minimize time, energy and data losses, or to avoid accidents and customer dissatisfaction.

There is a strong relation between maintenance and management through a new approach that called maintenance management which is orderly and systematic approach to planning, organizing, monitoring and evaluating maintenance activities and their costs (Ajiboye 2010). A good maintenance management system coupled with knowledgeable and capable maintenance staff can prevent health and safety problems and environmental damage; yield longer asset life with fewer breakdowns; and result in

lower operating costs and a higher quality of life, this is of course need a lot of hard works which is required to set up a successful maintenance management system.

To manage maintenance properly all maintenance must be performed so that equipment and systems operate efficiently and effectively. Improper maintenance and repairs can lead to unsafe conditions and reduced system performance. There are three main types of maintenance; these are corrective, preventive, and predictive maintenance.

2.3.1 Corrective Maintenance:

This type of maintenance need to trigger through direct observation, several definition for Corrective maintenance found, one of these definitions about this type of maintenance is a form of system maintenance which is performed after a fault or problem emerges in a system (Ogaji 2006), with the goal of restoring operability to the system of maintenance is done when the machine or service breaks down or stops, no actions or efforts are taken to maintain the equipment or service as requested by the designers to ensure the intended life. (Kumar 2010), another opinion said that Corrective maintenance is performed after a problem is detected in the system (Bruce Hawkins).

Some items of equipment located in the plant may have corrective maintenance performed by the operator or unskilled workmen at the plant site. To quantify the labor resource impact of work done on corrective maintenance tasks, trending corrective maintenance hours can provide feedback to evaluate the effectiveness of proactive activities, the corrective maintenance hours can define as "the percentage of maintenance labor that is used to restore equipment to a functional state after fault recognition".

Corrective maintenance can be divided into two types. These are: deferred and immediate. Deferred corrective maintenance which is also called planned corrective maintenance usually referred to that on non-critical equipment putting little influence on production. Such maintenance activities can be conducted together at a planned period afterwards without worrying about their negative impacts. In contrast immediate corrective maintenance refers to that on critical equipment affecting significantly on operation.in such case the problem must be coped with as much as possible despite there is no plan preparing for it. Thus it is also called unplanned corrective maintenance.

No matter which one of them, such maintenance types have many disadvantages such as curtailment in equipment life, consumption of spare parts, and reduction in benefits. For unplanned corrective maintenance, more severe consequences may happen such as delay in operation/production, increased probability of accidents, or lowered safety for both personnel and machinery.

Despite unexpected outcomes listed above, corrective maintenance cannot absolutely be eliminated because no one and no techniques can predict all the problems that could happen. Many factor such as ageing, corrosion and unexpected damages, etc. could result in unexpected failures.

In corrective maintenance we are really spending more money than we would have under a different maintenance approach. We may incur cost upon failure of a primary device/system associated with the failure of a secondary device/system. This is an increased cost we would not have experienced if our maintenance program was more proactive. Also our labor cost associated with repair will probably be higher than normal because the failure will most likely require more extensive repairs than would have been required if the equipment/system had not been run to failure. We will have to pay maintenance overtime cost. Since we expect to run equipment/system to failure, we

will require a large material inventory of repair parts/systems. This is a cost we could minimize under a different maintenance strategy.

Corrective maintenance may be executed in the form of:

(a) Repair may be minor or major.

(b) Replacement may be partial or total.

In fact, down time due to breakdown may consist not only of time taken to complete the repair work but also delays caused by lack of resources or information. Corrective or planned maintenance is required not only when the asset/machine item fails but also when indicated by condition based criteria. The following are the characteristics of Corrective Maintenance:

(1) A corrective maintenance activity is generally planned.

(2) A planned or unplanned corrective maintenance operation depends on the nature of break-down and type of equipment/machine.

(3) The maintenance work is taken up after the occurrence of a breakdown and with some permissible time lag.

(4) Breakdown maintenance should not be very serious in nature as far as production losses, down time, loss of human life etc. are concerned.

(5) Breakdown of individual equipment should not affect considerably the overall production loss.

In general breakdown maintenances are predictable and expected failures and hence they may be rectified over a long period of time without any time constraints.

The Objectives of Corrective Maintenance include:

(1) To get equipment/machine back into operation as quickly as possible in order to minimize the interruption to production. These objectives are directly related with production capacity, costs of production, product quality and consumer satisfaction.

(2) To control the cost of the operation of repair shops.

(3) To keep the cost of repair crew under control, including regular and overtime of labour costs.

(4) To control the investment in replacement of parts/components that are used/required when machines are repaired.

(5) To control the investment required for back up machines. These replace manufacturing machines are needed until the repairs are completed.

(6) To perform the appropriate amount of repairs at each malfunction of the asset/equipment.

(7) To restore an asset in working order.

(8) To maintain the operation availability of the plant and infrastructural facilities

(9) To avoid any sudden and heavy failure (breakdown) in future.

Applying the corrective maintenance needs skillful technicians and clear technical steps, below, are the general technical steps which can be followed in order to apply the corrective maintenance:

• Observation of break down.

• Diagnosis of failure.

• Analysis of failure.

• Selection of solution.

•Repair the failure.

•Test and learn

•Documentation and lessons learned.

Advantages of Corrective Maintenance include:

(1) Emergency maintenance requirements are reduced.

(2) Heavy down time losses are reduced.

(3) Plant availability is increased.

(4) Results in better utilization of plant facilities.

(5) Safety level is improved and hence there are less chances of accidents.

(6) Provides sufficient information concerning the maintenance replacement and repair.

The disadvantages of corrective maintenance includes:

• Increased cost due to unplanned downtime of equipment.

• Increased labor cost, especially if overtime is needed.

• Cost involved with repair or replacement of equipment.

• Possible secondary equipment or process damage from equipment failure.

• Inefficient use of staff resources.

•Breakdowns generally occur at inappropriate times. It may lead to a poor hurried maintenance and excessive delays in production schedules.

2.3.2 Preventive Maintenance:

The second type of maintenance is the preventive maintenance, this type of maintenance is consider one of the testing and checking steps to examine the operational conditions of the machine (or parts of it) by maintenance craftspeople and equipment operators, this steps are presented in a list, this list can be presented in electronic format or in a paper format and includes such activities as lubrication and inspections. Preventive maintenance defined as actions performed on a regular schedule to detect, prevent, or mitigate deterioration of a component or system in order to sustain or extend its useful life.

According to Industrial Accident Prevention Association, the definition of the preventive maintenance is predetermined work performed to a schedule with the aim of preventing the wear and tear or sudden failure of equipment components (M. Bagajewicz 2009) defined this type of maintenance as maintenance actions that help reduce the number of failures of specific equipment.

According to the previous definition of this preventive maintenance, the main goal of this type of maintenance is to prevent the equipment from failure and before the breakdown actually occurs.

It is designed to enhance equipment/system reliability by replacing worn components before they actually fail. Preventive maintenance activities include equipment/system checks, partial or complete overhauls at specified periods. In addition, workers can record equipment/system deterioration so that they know when to replace or repair worn parts components before they cause system failure.

All the above definition of preventive maintenance shows that the purpose of preventive maintenance is to minimize breakdowns and excessive depreciation.

According to the reliability center .Inc. there are several reasons of applying this type of maintenance, some of this reasons are:

• Longer equipment life.

• Minimize energy consumption.

• Need for a more organized, planned (Worsham 2011).

The advantages of this type of maintenance can be identified in the following points:

• Cost effective in many capital intensive processes.

• Flexibility allows for the adjustment of maintenance periodicity.

• Increased component life cycle.

• Energy savings.

• Reduced equipment or process failure.

• Estimated 12% to 18% cost savings over reactive maintenance program.

On the other hand preventive maintenance may not be effective because of the following:

• catastrophic failures still likely to occur.

• Labor intensive.

• Includes performance of unneeded maintenance.

•Potential for incidental damage to components in conducting unneeded maintenance.

2.3.3 Predictive Maintenance:

This type of maintenance deals with the maintenance activity needed to examine whether the system or part of it will continue working, and according to this system, it will fix or replace or otherwise. This type of maintenance is consider more suitable for factories, this type of maintenance is defined as follows compares the trend of measured physical parameters against known engineering limits for the purpose of

detecting, analyzing, and correcting problems before failure occurs" (Brown, 2003).

According to the Vesta partners in its articles An Integral Component of a Maintenance Strategy define the predictive maintenance as tools that are designed to monitor the health of equipment and system , another definition for the predictive maintenance is measurements that detect the onset of a degradation mechanism, thereby allowing causal stressors to be eliminated or controlled prior to any significant deterioration in the component/system physical state. Results indicate current and future functional capability, where Flow Solutions Division define the predictive maintenance as the maintenance that monitors each asset's condition to determine its fitness for continued operation and initiates repairs only when the machine itself starts crying for help (Brown, 2003). This maintenance measures and analyses data about deterioration and employs surveillance technology designed to monitor running conditions of an asset through an on-line system. When condition deviate from norm, remedial actions are taken (Pannerrselvam, 2009). Predictive maintenance is based on sensing that equipment is going to give trouble e.g. if noise and vibration have increased and thus prior arrangements for repair are done. In predictive maintenance, troubles are predicted before the equipment fails. Remedial measures are therefore executed and this extends the service life of equipment (Murthy, 2013).

The aim of predictive maintenance (PdM) is first to predict when equipment failure might occur, and secondly, to prevent the occurrence of the failure by performing maintenance. Monitoring for future failure allows maintenance to be planned before the failure occurs. Ideally, predictive maintenance allows the maintenance frequency to be as low as possible to prevent unplanned reactive maintenance, without incurring costs associated with doing too much preventive maintenance.

Predicting failure can be done with one of many techniques. The chosen technique must be effective at predicting failure and also provide sufficient warning time for upcoming maintenance. Some techniques include vibration analysis, oil analysis, thermal imaging, and equipment observation. Choosing the correct technique for performing condition monitoring is an important consideration that is best done in consultation with equipment manufacturers and condition monitoring experts.

When predictive maintenance is working effectively as a maintenance strategy, maintenance is only performed on machines when it is required. That is, just before failure is likely to occur. This brings several cost savings such as:

- Minimizing the time the equipment is being maintained
- Minimizing the production hours lost to maintenance, and
- Minimizing the cost of spare parts and supplies.

These cost savings come at a price, however. Some condition monitoring techniques are expensive and require specialist and experienced personnel for data analysis to be effective.

The Advantages of predictive maintenance includes:

• Increased component/system operational life/availability.

• Allows for preemptive corrective actions.

• Decrease process downtime.

• Decrease in costs for parts and labor.

• Better product/service quality.

• Improved worker and environmental safety.

• Improved worker moral.

• Energy savings.

The disadvantages of predictive maintenance include:

• Compared with preventive maintenance, the cost of the condition monitoring equipment needed for predictive maintenance is often high. The skill level and experience required to accurately interpret condition monitoring data is also high. Combined, these can mean that condition monitoring has a high upfront cost. Some companies engage condition monitoring contractors to minimize the upfront costs of a condition monitoring program.

• Not all assets have failures that may be more cost-effectively maintained using preventative maintenance or a run-to-failure maintenance strategy. Judgment should be exercised when deciding if predictive maintenance is best for a particular asset. Techniques such as reliability-centered maintenance provide a systematic method for determining if predictive maintenance is a good choice as an asset maintenance strategy for the particular asset of interest.

• Increased investment in diagnostic equipment.

• Savings potential not readily seen by management.

2.4.1 Review of Related Empirical Studies

In this section of the study, relevant works carried out by various researchers through experimental design pertaining to maintenance practices to ensure effective instructions in polytechnics' workshops and laboratories have been reviewed in support of this study.

Ede and Attama (2010) conducted a study on the workshop management techniques needed for improving the performance of metalwork teachers in Technical Colleges in Abia and Enugu States. The main purpose of the study was to identify the planning, organizing, coordinating and the evaluating techniques that are required by metalwork teachers for improving their performance in managing the technical schools' metal workshops. The survey research design was employed for the study. A total sample size of 62 (16 heads of departments and 46 metal work teachers) respondents were randomly selected and used for the study. A structured questionnaire was used for data collection. The mean and t-test were used for data analysis. Findings from the study indicated that the following techniques were needed for improving the performance of metalwork teachers in technical colleges in Abia and Enugu States. Thus: the planning technique includes, among others, drawing up programme plan, consideration of duration for workshop lesson, setting standards for metalwork activities and developing work objectives in measurable terms. The organizing technique include, among others, arrangement of tools so that the supervisor can inspect and identify immediately iron out, broken and lost ones as well as delegating functions to those involved in the workshop lesson,

This work is related to the present study as both studies focus on workshop management techniques for improving teaching in technical colleges. While Ede and Attama's work is concerned with workshop management techniques needed for improving the performance of metal work teachers in Technical colleges, the present study focused on maintenance practices of instructors electrical and electronics workshop and laboratories in polytechnics.

Gyallesu (2005) conducted a study on management skills improvements needs of technicians for managing electronic maintenance shop in Kaduna State. The main

purpose of the study was identification of management skill, improvement needs of technicians for managing electronics maintenance shop, identifying organizational Skills improvement needs, determining personnel and other personal skills required by the technician for Electrical/Electronic maintenance shop.

The major findings of the study are organizational skill improvement needs of the technicians for managing Electronics maintenance shop include:

(a) Ability to properly coordinate group activities.

(b) Skill in monitoring tidy and well ventilated shop

(c) Skill in the development of shop to achieve objectives

(d) Regular inspection of tools/materials and equipment in the workshop.

Personal and inter-personal skill improvement needs of technicians for managing Electronics maintenance shop includes:

(a) Ability to communicate effectively with customers

(b) Willingness to seek advice of technicians from other shop

(c) Desire to set high standard in job performance

(d) Skill to evaluate personal strength and weakness.

Skill improvement needs of technicians on record keeping for effective management of Electronics maintenance shop.

(a) Ability to correctly record when an item is brought to the shop for repair

(b) Skill in recording price of parts/component and materials purchase.

(c) Ability to record the amount deposited by customers and the remaining balance.

There is no doubt that the technician requires better skill for managing electronics maintenance shop in Kaduna State. The study reveals that management skill improvements are needed in virtually all the areas the researcher asked questions.

Agu (2012) in descriptive survey study investigated on effective management of workshop resources in selected secondary schools in Nassarawa State with the purpose of determining the teachers perceptions on management practices used for the teaching of introductory technology. He specifically wanted to determine teachers' perceptions on organization of facilities and maintenance practices in the workshops as well as budgeting for the workshops. A total of 84 introductory technology teachers and 30 principles were randomly selected from selected secondary schools in eight (8) educational zones of Nassarawa State to participate in the study. A questionnaire was used as an instrument for gathering data for the study. The following findings were made:

The State of introductory technology workshops in secondary schools in Nassarawa State is deplorable since teachers are over loaded due to the introduction of UBE programme and they have no time to organize the workshops. The secondary schools in Nassarawa State lack maintenance culture. Proper budgeting and funding for the schools' workshops are the major problems in secondary schools in Nassarawa State.

This work is related to the present study as both studies focus on workshop management aimed at improving teaching, while Agu's work is concerned with effective management of workshop resources, however, it differs in the sense that Agu's work was concerned with effective management of workshop resources, the present study deals with maintenance practices of instructors in workshop and laboratories for improving electrical and electronics engineering technology in polytechnics.

A study was carried out by Usman (2013) on identification of workshop organization technique for improving teaching-learning process in selected post-primary institutions in Kaduna State. His purpose for the study was to: identify the facilities available in the

technical school workshop, find out which organizational system was used in the workshop, find out management practices that were adopted to enhance teaching-learning process in the workshop, identify safety precautions that would improve general survey design. A structured questionnaire was adopted to obtain data from 224 technical teachers and 69 principals who were randomly selected from the post-primary institutions in Kaduna as a sample for the study. The researcher analysed data using mean and chi-square and came out with the following major findings:

Tools storage and teachers' offices are the only two facilities that were provided in all the 56 post-primary institutions' workshops in the study; none of the 56 post-primary institutions in the study offers their technical programme in one workshop only. Each trade has its own workshop separately.

This work is related to the present study because while Usman's work is concerned with identification of workshop organization technique, however, it differs in the sense that Usman's work was only concerned with workshop organization techniques, while the present study deals with workshop maintenance practices.

Mkpozi (2016) conducted a survey research to determine whether the equipment maintenance project (EMP) has improved workshops in Polytechnics offering Electrical/Electronic course in South-East Zone of Nigeria since its inception. The population comprised all lecturers, instructors, technologists and technicians in all the civil, electrical/Electronic and Mechanical Engineering departments of the polytechnics in the South-East Zone. There were altogether 258 participants, with no sample taken. Frequency counts, mean, percentages and rank order were used to answer the research questions, while t-test, Chi-square and ANOVA were used to test the hypotheses at 0.05 level of probability. The results revealed that the extent of reactivated faulty equipment

in all the polytechnics was high; and that participants competence after training was highly dependent on place of training.

This work is related to the present study because both studies focus on improvement of workshops in technical colleges and polytechnics. However they differ in the sense that Mkpozi's study was to determine whether the equipment maintenance project (EMP) has improved workshops, while the present sought to identify workshop management techniques required by electrical technology teachers.

Ibeneme (1997) investigated the perceived roles of technical teachers in the maintenance of workshop equipment in Anambra and Enugu States. The research design was a cross-sectional survey that covered all secondary schools and technical colleges in the two states. The population of the study consisted of 706 technical teachers, 519 principals and 519 vice principals (administration) in the service of the two states. Through random sampling technique, 624 subjects were selected and used for the study. Questionnaire was used for data collection, while frequency counts, percentages, mean, analysis of variance, Chi-square and t-test were used for data analysis. Results showed that technical teachers perceived roles included carrying out preventive maintenance services, maintenance management and teaching students how to maintain school workshop equipment.

This work is related to the present study but however, they differ in the sense that the past study was concerned with maintenance of workshop equipment, while the present study is concerned with maintenance practices of instructors in an electrical and electronics workshop and laboratories in polytechnics.

Ogbuanya (2009) worked on the development of a system for the maintenance of technical college workshop equipment. This developmental study was designed to

provide a system for maintenance of technical college workshop equipment. The study was a survey that covered five Eastern States of Nigeria and questionnaire was used for data collection. Population of the study was made up of 466 technical college personnel and 35 technical education lecturers making a total of 501 respondents. No sampling was taken as the entire population was used. Frequency counts, percentages, mean and t-test were used for data analysis.

The results showed the maintenance roles to be performed by various technical college personnel including technical college students and the method to be adopted in maintenance of equipment. The findings from the study were used to develop a system for the maintenance of technical college workshop equipment. That should be adopted for effective implementation of maintenance programme in technical colleges.

This study is related to the present study because both studies focus on workshop management, in technical colleges. However, Ogbuanya's work differs in the sense that it was concerned with maintenance of workshop equipment. The present study is concerned with maintenance practices of instructors in an electrical and electronics workshop and laboratories in polytechnics.

Amadi (2008) surveyed on evaluation of practical utilization of workshop facilities in technical colleges in Abuja municipal Area Council. The purpose of the study was to find out: The workshop facilities available for electrical/electronic practical in the technical colleges, the facilities that are in actual use in the workshops of the technical colleges, and the personnel available for the practical utilization of the facilities available in the workshop.

Forty electrical technology teachers and sixteen principals were randomly sampled for the study. A structured questionnaire was used for data collection. Simple percentages were used to analyze the data. The findings of the study were:

Basic tools and equipment in electrical fields were inadequate, most machinery such as soldering machines, drilling machines, piping machine etc were not in actual use in the workshop due to lack of adequate power supply, the workshops lack trained attendants and skilled field personnel.

This work is related to the present study because both studies focus on workshop management in technical colleges. Amadi's work differs in the sense that, it dealt with utilization of workshop facilities in technical colleges, while the present study focused on the maintenance practices of instructors in an electrical and electronics workshop and laboratories in polytechnics.

2.5.1 Summary of Literature Reviewed

This chapter reviewed related literatures on the maintenance practices of instructors in electrical and electronics engineering workshops and laboratories in polytechnics in Niger State. The review was conducted under the following sub-headings for effective and efficient literature review process. The study reviewed polytechnic education in Nigeria, electrical and electronics engineering technology, and maintenance practices.

The review of literature shows inefficient maintenance skill on the part of instructors. The literature shows that instructors need more maintenance skill improvement in order to carry out workshop practices more effectively. The review of literature also provide an insight to what is expected of the instructors and students in terms of workshop maintenance practices skills acquisition for more effective teaching and learning. These

skills are in the area of planning, coordinating and directing maintenance improvement needs.

Most of the studies conducted in this area focuses on workshop management and maintenance of technical college workshop and none was carried in the area of maintenance practices of instructors. From the literature review none known to me has specifically focused on maintenance practices of instructors in electrical workshop and laboratories in polytechnics and this is the gap the study is set to fill.

CHAPTER THREE

3.1 RESEARCH METHODOLOGY

This chapter presents the methods and procedures that the researcher employed in the process of collecting necessary and useful data for this research. It has been presented under the following sub-headings: design of the study, area of the study, population of the study, sample and sampling techniques, instrument for data collection, validation of the instrument, reliability of the instruments, administration of the instrument, method of data collection and method of data analysis.

3.2 Design of the study

This study adopted a descriptive survey design. Descriptive survey research according to Nworgu (2006) is a systematic means of data collection. It is aimed at collecting data describing the characteristics, features of facts about a given population using questionnaire interviews and observation as instruments for data collection. This descriptive survey research design is considered suitable since this study will solicit for information from the electrical and electronics engineering lecturers and instructors on the maintenance practices of instructors in electrical and electronics workshop and laboratories in polytechnics in Niger state.

3.3 Area of the study

This study was carried out in Niger State. There are two polytechnics in Niger State. The polytechnics are The Federal Polytechnic Bida and Niger State Polytechnic Zungeru.

3.4 Population of the study

The population for the study comprised 25 lecturers in the department of electrical and electronic engineering and 10 workshop and laboratory instructors in both polytechnics in Niger state. The entire population was used for the study since it was not too large.

3.5 Sample and sampling techniques

A sample size comprises of the total number of population elements or sampling units that are selected (i.e sampled) for investigation in a research study (Murphy and Bird, 2012) in addition Meyers (2003) emphasized that a good sample size must be a near representative of the entire population as possible for the generalization of the findings. In a condition where the population is small and all the criteria that are needed to be investigated exist in the small population there is technically no need for any sampling. There will be no sampling as the entire population will be used for the study.

3.6 Instrument of Data Collection

The questionnaire was chosen as instrument because of its usefulness as a tool for gathering data from a large number of respondents in a relative short period. The questionnaire will be administered to the lecturers and instructors in the department of electrical and electronics engineering technology in both Federal Polytechnic Bida and Niger State Polytechnic Zungeru. The questionnaire was structured in a clear and simple language so as to enable the respondents to provide relevant answers to the questionnaire based on their personal perceptions.

The questionnaire consists of two major sections: section A and section B. section A which contain the introduction and the status of the respondent. While section B contains 30 statement bothering on the maintenance practices of instructors in electrical

and electronics engineering workshop and laboratories in polytechnic in Niger state. In section A, the lecturers and instructors is expected to respond to each of the items by ticking (√) while in section B, the lectures and instructors was asked to respond to the responses made for the items using the scale of Very Highly Adopted (VHA) Highly Adopted (HA) Rarely Adopted (RA) Not Adopted (NA). The researcher decides to use this scale because it is the most widely used in this type of research (George and Juddy, 2010). The adoption of this scale was also based on the ground that the respondents are well educated, and therefore could easily understand the appropriate way to respond to the statement. The logic behind this scale is that people are assumed to discriminate systematically in their views. Their discriminations form a continuum for positive or negative orientation to the statements.

3.7 Validation of research instrument

The instrument for data collection was subjected to face validation by three experts from the department of Industrial and Technology Education, Federal University of Technology Minna. The instrument was given to the researcher's supervisor and three other lecturers in the department to determine the relevance and suitability of the instrument for the study using a checklist containing the following

1. Language clarity to target population; Content coverage in terms of adequacy and inadequacy; and How relevant to the stated objectives.

The essence of given out the instrument for validation was to make necessary modifications based on their comments and suggestions.

3.8 Reliability of the Instrument

The reliability of the instrument was established using Cronbach's Alpha (α) to determine the internal consistency of the instrument. The instrument was administered to eight electrical lecturers and instructors in College of Education (Technical) Minna Niger State. The data obtained from the respondents was computed in Cronbach's alpha to determine the reliability co-efficient at 0.87. College of Education (Technical) Minna, Niger State was selected because of its relevance demographic attributes with the study area.

3.9 Administration of the Instrument

The researcher administered the instrument to the respondents through personal contact and with the help of two research assistants. The research assistant was given instructions on how to administer the questionnaire. The questionnaire was administered in the two polytechnics in Niger state. The copies of the questionnaire were collected some days after by the researcher and his assistant. Thirty-five questionnaires were administered and twenty-nine was returned. Below is the percentage % of the questionnaire returned. Number of questionnaire returned/number of questionnaire administered × 100 29/35 ×100= 82.9%.

3.10 Method of Data Analysis

The data collected for this study was analyzed using Mean to answer the research questions while t-test was used to test the null hypothesis at 0.05 level of significance. Each item was accepted as Adopted if the calculated mean of any item is greater or equal to 2.50 while mean of any item below 2.50 was considered as Not Adopted.

The null hypothesis of no significant difference was accepted for any item whose t-calculated value is less than the t-table value, while it was rejected for any item whose t-calculated value is greater than the t-table value.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Research Question 1

What are the various preventive maintenance practices in electrical and electronics workshop?

Table 4.1

Table 4.1 presents the mean response of Lectures and Instructors on the various preventive maintenance practices in electrical and electronics workshop

N_1= 23, N_2= 6

S/N	ITEM	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_r$	REMARKS
1	Regular testing and checking of machines and equipment by workshop instructors.	3.78	3.83	3.81	Adopted
2	Instructors embark on tasks aimed at improving the state of the facility in the polytechnic so as to sustain its utilization and value.	3.74	3.83	3.79	Adopted
3	Regular cleaning of tools, machines and equipment in the workshop and laboratories immediately after use.	3.70	3.67	3.68	Adopted
4	Replacing defective or obsolete machine parts before they reduce the efficiency of the entire equipment.	3.35	3.33	3.34	Adopted
5	Servicing of machines and equipment's that are in need of a fine tuning.	3.43	3.50	3.47	Adopted
6	Regular checking of all control lamps, indicators, tachometer, hour meter etc.	3.65	3.67	3.66	Adopted
7	Instructor's schedules maintenance according to equipment usage.	3.70	3.67	3.68	Adopted
8	Cleaning and lubrication of moving machine parts such as bearings and other contact.	3.83	3.17	3.50	Adopted
9	Switching off machines when taking measurements.	3.78	3.50	3.64	Adopted
10	Ensuring that fragile and highly sensitive laboratory gadget such as oscilloscope is enclosed in a safe place to avoid damage.	3.91	3.83	3.87	Adopted

Source: Researchers own field, 2018.

$\bar{X}_1$ = Average of Lectures response

$\bar{X}_2$ = Average of Investors response

$\bar{X}r$ = Mean average of Lecturers and Investors response

N_1 = Total number of Lectures

N_2 = Total number of Investors

From Table 4.1 It was revealed that both the lecturers and instructors very highly adopte with all the under listed items. This there for showcases a significant and substantial level of espousal to the various preventive maintenance practices in electrical and electronics workshop.

4.2 Research Question 2

What are the predictive maintenance practices in electrical and electronics workshop in polytechnics?

Table 4.2

Table 4.2 presents the mean response of Lecturers and Investors on the predictive maintenance practices in electrical and electronics workshop in polytechnics N_1= 23, N_2= 6

S/N	ITEM	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_r$	REMARKS
1	Carrying out conditional-based monitoring to detect potential failures.	3.52	3.33	3.43	Adopted
2	Detecting increase in noise and vibration of equipment when switched on.	4.00	3.83	3.92	Adopted
3	Monitoring signals of equipment light indicators and Meters	3.35	3.33	3.34	Adopted

S/N	ITEM	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_r$	REMARKS
4	Detecting, analyzing and correcting problems before failure occurs.	3.70	3.67	3.68	Adopted
5	Carrying out some simple physical test like the pre-stress checking of bolts and nut of workshop machine and equipment.	3.65	3.50	3.58	Adopted
6	Applying visual inspection to ascertain the condition of workshop equipment.	3.30	3.50	3.40	Adopted
7	Detecting the onset of a degradation of mechanism to eliminate casual stressor.	3.13	3.00	3.07	Adopted
8	Examining whether the systems or part of it will continue to work.	3.30	3.17	3.24	Adopted
9	Eliminating unnecessary shutdown of equipment through predictive measures.	3.83	3.83	3.83	Adopted
10	Analyzing data about deterioration and employing surveillance technology.	3.43	3.67	3.55	Adopted

Source: Researchers own field, 2018.

$\bar{X}_1$ = Average of Lectures response

$\bar{X}_2$ = Average of Investors response

$\bar{X}r$ = Mean average of Lecturers and Investors response

N_1 = Total number of Lectures

N_2 = Total number of Investors

From Table 4.2 It was revealed that both the management staffs and maintenance engineers very highly adopted with all the under listed items. This there for showcases a significant and substantial level of espousal to the predictive maintenance practices in electrical and electronics workshop in polytechnics.

4.3 Research Question 3

What are the corrective maintenance practices in electrical and electronics workshop in polytechnics?

Table 4.3

Table 4.3 presents the mean response of Lecturers and Instructors on the corrective maintenance practices in electrical and electronics workshop in polytechnics N_1= 23, N_2= 6

S/N	ITEM	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_r$	REMARKS
1	Carrying out deferred or planned corrective maintenance on non-critical equipment in the workshop.	3.09	3.00	3.04	Adopted
2	Ensuring that the faults or break down of equipment in the workshop or laboratory are urgently rectified to mitigate against further depletion in their functionality.	3.87	3.50	3.68	Adopted
3	Restoration of operability to equipment or machine or service breakdown according to the manufacturers to ensure the intended life.	3.43	3.50	3.47	Adopted
4	Always planning the repairs of items or equipment as contained in the drafted schedule of work.	3.91	3.83	3.87	Adopted
5	Carrying out partial or total replacement of equipment.	3.57	2.83	3.20	Adopted
6	Correcting poor quality. For example, maintenance of machine and equipment to correct vibration that are causing noise in workshop.	3.52	3.67	3.59	Adopted
7	Incurring cost on failure of a primary device or system associated with the failure of a secondary device or system.	3.83	3.17	3.50	Adopted
8	Carrying out check to determine the cause of break down before carrying out corrective measures	3.61	3.33	3.47	Adopted
9	Carrying out repairs of some items of equipment located in the plants.	3.91	3.17	3.54	Adopted
10	Maintenance of equipment that experience unexpected failures as a result of aging, corrosion and unexpected damage.	3.87	3.83	3.85	Adopted

Source: Researchers own field, 2018

$\bar{X}_1$ = Average of Lectures response

$\bar{X}_2$ = Average of Investors response

$\bar{X}r$ = Mean average of Lecturers and Investors response

N_1 = Total number of Lectures

N_2 = Total number of Investors

From Table 4.3 it was revealed that both the management staff and maintenance engineers agree with all the under listed items. This there for showcases a significant and substantial level of espousal to the corrective maintenance practices in electrical and electronics workshop in polytechnics.

4.4 Research Hypothesis

4.4.1 Hypothesis 1

There is no significant difference between the mean responses of polytechnic instructors in workshop and laboratories on preventive maintenance practices in electrical and electronics engineering workshop.

Table 4.4.1

T-test analysis of the respondents concerning the various preventive maintenance practices in electrical and electronics workshop

S/N	ITEM	SD_1	SD_2	t-test	REMARKS
1	Regular testing and checking of machines and equipment by workshop instructors.	0.35	0.88	-0.11	NS
2	Instructors embark on tasks aimed at improving the state of the facility in the polytechnic so as to sustain its utilization and value.	0.72	1.16	-0.15	NS
3	Regular cleaning of tools, machines and equipment in the workshop and laboratories immediately after use.	0.79	0.55	0.09	NS
4	Replacing defective or obsolete machine parts before they reduce the efficiency of the entire equipment.	0.62	0.77	0.03	NS
5	Servicing of machines and equipment's that are in need of a fine tuning.	0.40	1.30	-0.09	NS
6	Regular checking of all control lamps, indicators, tachometer, hour meter, etc.	0.56	0.88	-0.03	NS
7	Instructor's schedules maintenance according to equipment usage.	0.82	0.67	0.07	NS

S/N	ITEM	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_r$	REMARKS
8	Cleaning and lubrication of moving machine parts such as bearings and other contact.	0.91	1.23	0.92	NS
9	Switching off machines when taking measurements.	0.55	0.68	0.74	NS
10	Ensuring that fragile and highly sensitive laboratory gadget such as oscilloscope is enclosed in a safe place to avoid damage.	0.56	1.12	0.14	NS

Source: Researchers field, 2018.

Keys: NS = Not Significant, S = Significant, SD = Standard Deviation, Degree of Freedom = 33, t-value = 1.69

From table 4.4.1 the analysis shows that each of the ten (10) items in table 4.4.1 had their estimated t-values rank between -0.15 to 0.90 which were in comparison lower than the t-value of 1.69 at 0.05 level of significance and at 33 degree of freedom (DF). As an indication, this implies that there was no significant difference between the mean responses of polytechnic instructors in workshop and laboratories on preventive maintenance practices in electrical and electronics engineering workshop.

4.4.2 Hypothesis 2

There is no significant difference between the mean responses of polytechnic instructors in workshop and laboratories on predictive maintenance practices in electrical and electronics engineering workshop.

Table 4.4.2

T-test analysis of the respondents concerning the various preventive maintenance practices in electrical and electronics workshop

S/N	ITEM	SD_1	SD_2	t-test	REMARKS
1	Carrying out conditional-based monitoring to detect potential failures.	0.44	0.76	0.44	NS
2	Detecting increase in noise and vibration of equipment when switched on.	0.73	1.03	0.30	NS
3	Monitoring signals of equipment light indicators and meters	0.79	0.67	0.04	NS
4	Detecting, analyzing and correcting problems before failure occurs.	0.76	0.89	0.06	NS
5	Carrying out some simple physical test like the pre-stress checking of bolts and nut of workshop machine and equipment.	0.67	1.43	0.20	NS
6	Applying visual inspection to ascertain the condition of workshop equipment.	0.66	1.30	-0.28	NS
7	Detecting the onset of a degradation of mechanism to eliminate casual stressor.	0.45	0.71	0.31	NS
8	Examining whether the systems or part of it will continue to work.	0.91	1.10	0.21	NS
9	Eliminating unnecessary shutdown of equipment through predictive measures.	0.44	0.60	-0.02	NS
10	Analyzing data about deterioration and employing surveillance technology.	0.88	1.12	-0.38	NS

Source: Researchers field, 2018.

Keys: NS = Not Significant, S = Significant, SD = Standard Deviation, Degree of Freedom = 33, t-value = 1.69

From Table 4.4.2 the analysis shows that each of the ten (10) items in table 4.4.2 had their estimated t-values rank between -0.38 to 0.44 which were in comparison lower than the t-value of 1.69 at 0.05 level of significance and at 33 degree of freedom (DF). As an indication, this implies that there was no significant difference between the mean

responses of polytechnic instructors in workshop and laboratories on predictive maintenance practices in electrical and electronics engineering workshop.

Consequently, the null hypothesis 1 gain acknowledgement at 0.05 level of significance at 33 degree of freedom.

4.4.3 Hypothesis 3

There is no significant difference between the mean responses of polytechnic instructors in workshop and laboratories on corrective maintenance practices in electrical and electronics engineering workshop.

Table 4.4.3

T-test analysis of the respondents concerning the corrective maintenance practices in electrical and electronics workshop in polytechnics

S/N	ITEM	SD_1	SD_2	t-test	REMARKS
1	Carrying out deferred or planned corrective maintenance on non-critical equipment in the workshop.	0.98	0.88	0.16	NS
2	Ensuring that the faults or break down of equipment in the workshop or laboratory are urgently rectified to mitigate against further depletion in their functionality.	0.89	1.16	0.57	NS
3	Restoration of operability to equipment or machine or service breakdown according to the manufacturers to ensure the intended life.	0.45	0.42	-0.27	NS
4	Always planning the repairs of items or equipment as contained in the drafted schedule of work.	0.87	0.77	0.18	NS
5	Carrying out partial or total replacement of equipment.	0.62	1.30	0.93	NS
6	Correcting poor quality. For example, maintenance of machine and equipment to correct vibration that is causing noise in workshop.	0.61	0.88	-0.30	NS
7	Incurring cost on failure of a primary device or system associated with the failure of a secondary device or system.	0.85	0.67	1.58	NS

S/N	ITEM	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_r$	REMARKS
8	Carrying out check to determine the cause of break down before carrying out corrective measures	0.43	0.68	0.72	NS
9	Carrying out repairs of some items of equipment located in the plants.	0.70	0.69	1.80	S
10	Maintenance of equipment that experience unexpected failures as a result of aging, corrosion and unexpected damage.	0.83	0.56	0.11	NS

Source: Researchers own field, 2018.

Keys: NS = Not Significant, S = Significant, SD = Standard Deviation, Degree of Freedom = 33, t-value = 1.69

From tables 4.5 the analysis shows that items 1, 2, 3, 4, 5, 6, 7, 8 and 10 had their estimated t-values rank between -0.03 to 1.58 which were in comparison lower than the t-value of 1.69 at 0.05 level of significance and at 33 degree of freedom (DF). But item 9 had its t-value calculated at 1.80 higher than the level of significance and t-value of 1.69. The null hypothesis 3 was hence forth rejected at a significance level of 0.05 and 33 degree of freedom. As an indication, this implies that there is a significant difference between the mean responses of polytechnic instructors in workshop and laboratories on corrective maintenance practices in electrical and electronics engineering workshop.

4.5 Findings of the Study

The outcomes of the study findings are shown in the following

iv. Various preventive maintenance practices in electrical and electronics workshop were ascertained by the study

i. Ensuring that fragile and highly sensitive laboratory gadget such as oscilloscope is enclosed in a safe place to avoid damage.

ii. Regular testing and checking of machines and equipment by workshop instructors.

iii. Instructors embark on tasks aimed at improving the state of the facility in the polytechnic so as to sustain its utilization and value.

iv. Regular cleaning of tools, machines and equipment in the workshop and laboratories immediately after use.

v. predictive maintenance practices in electrical and electronics workshop in polytechnics were ascertained by the study

   i. Detecting increase in noise and vibration of equipment when switched on.

   ii. Eliminating unnecessary shutdown of equipment through predictive measures.

   iii. Detecting, analyzing and correcting problems before failure occurs.

   iv. Applying visual inspection to ascertain the condition of workshop equipment.

vi. Corrective maintenance practices in electrical and electronics workshop in polytechnics were ascertained by the study

   i. Always planning the repairs of items or equipment as contained in the drafted schedule of work.

   ii. Maintenance of equipment that experience unexpected failures as a result of aging, corrosion and unexpected damage.

   iii. Ensuring that the faults or break down of equipment in the workshop or laboratory are urgently rectified to mitigate against further depletion in their functionality.

   iv. Correcting poor quality. For example, maintenance of machine and equipment to correct vibration that is causing noise in workshop.

   v. Carrying out repairs of some items of equipment located in the plants.

4.6 Discussion of the Results

The results ascertained from the research study were discussed on the premise of the formulated hypothesis and research study developed for the study.

From the analysis of the results of question (1), it was revealed that the major preventive maintenance practices in electrical and electronics workshop a as follows; Ensuring that fragile and highly sensitive laboratory gadget such as oscilloscope is enclosed in a safe place to avoid damage; Regular testing and checking of machines and equipment by workshop instructors; Instructors embark on tasks aimed at improving the state of the facility in the polytechnic so as to sustain its utilization and value; Regular cleaning of tools, machines and equipment in the workshop and laboratories immediately after use. This is in line with the findings of Bagajewicz (2009) preventive maintenance is a series of maintenance actions that help reduce the number of failures of specific equipment and its main goal is to prevent the equipment from failure and before the breakdown actually occurs.

From the analysis of the results of question 2, it was revealed that the major predictive maintenance practices in electrical and electronics workshop in polytechnics were ascertained by the study to include; Detecting increase in noise and vibration of equipment when switched on; Eliminating unnecessary shutdown of equipment through predictive measures; Detecting, analyzing and correcting problems before failure occur; Applying visual inspection to ascertain the condition of workshop equipment. This is in accordance with the findings of Murthy (2013) who was of the opinion that in predictive maintenance, troubles are predicted before the equipment fails. Remedial measures are therefore executed and this extends the service life of equipment.

From the analysis of the results of question 3, it was revealed that the major corrective maintenance practices in electrical and electronics workshop in polytechnics were ascertained by the study to include; Always planning the repairs of items or equipment as contained in the drafted schedule equipment; Maintenance of equipment that experience unexpected failures as a result of aging, corrosion and unexpected damage; Ensuring that the faults or break down of equipment in the workshop or laboratory are urgently rectified to mitigate against further depletion in their functionality; Correcting poor quality (For example, maintenance of machine and equipment to correct vibration that are causing noise in workshop); Carrying out repairs of some items of equipment located in the plants. This result correlates with the findings of Ogaji (2006) who asserted that corrective maintenance is a form of system maintenance which is performed after a fault or problem emerges in a system with the goal of restoring operability to the system and it is done when the machine or service breaks down or stops, no actions or efforts are taken to maintain the equipment or service as requested by the designers to ensure the intended life.

Hypothesis 1 as shown in tables 4.4.1 reveals that there is no significant difference between the mean responses of polytechnic instructors in workshop and laboratories on preventive maintenance practices in electrical and electronics engineering workshop. It was revealed by the t-test analysis that all the items were adopted on by the respondents.

Hypothesis 2 as shown in tables 4.4.2 reveals that there is no significant difference between the mean responses of polytechnic instructors in workshop and laboratories on predictive maintenance practices in electrical and electronics engineering workshop. It was revealed by the t-test analysis that all the items were adopted on by the respondents.

Hypothesis 3 as shown in tables 4.4.3 reveals that there is significant difference between the mean responses of polytechnic instructors in workshop and laboratories on corrective maintenance practices in electrical and electronics engineering workshop. The t-test calculated shows that nine of the items had their estimated t-values rank between -0.03 to 1.58 which were in comparison lower than the t-value of 1.69 at 0.05 level of significance and at 33 degree of freedom (DF). But item 9 had its t-value calculated at 1.80 higher than the level of significance and t-value of 1.69. The null hypothesis 3 was hence forth rejected at a significance level of 0.05 and 33 degree of freedom. Hence forth, both the lecturers and instructors agree that the major corrective maintenance practices in electrical and electronics workshop in polytechnics includes; Always planning the repairs of items or equipment as contained in the drafted schedule equipment; Maintenance of equipment that experience unexpected failures as a result of aging, corrosion and unexpected damage; Ensuring that the faults or break down of equipment in the workshop or laboratory are urgently rectified to mitigate against further depletion in their functionality; Correcting poor quality (For example, maintenance of machine and equipment to correct vibration that are causing noise in workshop); Carrying out repairs of some items of equipment located in the plants.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter focuses on discussion of the findings, conclusion drawn from the findings, and recommendations. Other aspects included are the limitation to the study and suggestions for further research

5.1 Summary

This research work reviewed the maintenance practices of instructors in electrical and electronics engineering workshop and laboratories in polytechnic in Niger State. A survey research was used for the study. The instrument was a 30 structured questionnaire developed after a review of literature on maintenance practices of instructors in polytechnics, and also based on the research questions that guided the study.

The instruments was validated by experts and also tested for reliability which yielded reliability co-efficient of 0.87. the questionnaire was distributed to a total population of 35 electrical/ electronic engineering lectures and instructors in Federal Polytechnic Bida and Niger State Polytechnic Zungeru. 29 out of the 35 questionnaire administered were returned representing 83.4 percent return rate. In analyzing the data mean and standard deviation were used to answer the research question while t-test was used to test the null hypothesis at 0.05 level of significance.

5.2 Conclusion

The research explored the divergent views of instructors and supervisors on the preventive, predictive and corrective maintenance practices of instructors in electrical and electronics engineering workshop and laboratories in polytechnics. The result obtained from data gathered and analyzed in this study indicated that there are no significant differences in the views of the instructors on the areas mentioned above.

The findings of the research also established that polytechnic lecturers are proficient in the management of electrical and electronic engineering workshops and laboratories.

5.3 Implication of the findings

Based on the findings of the study, the following implications can be drawn:

The findings have strong implications for the management of workshops and laboratories in higher institutions in Nigeria. It is an indication that there would be a great improvement in the administration of laboratories and workshop in our tertiary institution.

The result of the study showed that there were no significant differences in the views of the instructors on the preventive maintenance practice in electrical and electronics engineering workshops and laboratories, no significant differences in the views of instructors on the predictive maintenance practice in electrical and electronics engineering workshops and laboratories; and no significant differences in the corrective maintenance practices of instructors in electrical and electronics workshops and laboratories in those institutions.

5.4 Recommendations

Based on the findings and conclusion of this study, the following recommendations were made:

1. Government should give special consideration to the management of our laboratories and workshops in all tertiary institutions in the country

2. Polytechnic lecturers should help themselves by exhibiting high positive attitudes and competences in the management of electrical and electronics laboratories.

3. Government should formulate workable science policies that will address our educational challenges Nigeria tertiary institution.

4. Government must also ensure that all laboratory and workshops in Nigeria higher institutions are provided with sufficient science equipment to enable students learn adequately.

5.5 Contribution to Knowledge

The findings of this study will help the lecturers, workshop instructors and the institution management to meet the stated objectives. The findings of this study will provide information to electrical electronics instructors on the maintenance practices skills required by them. The identified maintenance practice skills could be used by these instructors to train their students in the workshops thereby reduce unnecessary teaching stress. The instructors will benefit from this study since the information gathered will create awareness for them on the maintenance practice skills and also help them to attend re-training programmes on maintenance practice education for improvement and efficiency in the Electrical and electronics workshop.

5.6 Suggestions for Further Studies

For further researches in this area, the following were suggested:

1. Effort to replicate this study in other zones of Nigeria and in other Africa countries should be supported. Comparison of their findings would authenticate their validations.

2. Further studies should be focused on lectures competences and frequency of usage of laboratories and workshop for research.

3. Future studies can as well focus on the lecturers in the universities.

4. Technical skills needs of electrical/electronic workshop instructors for improving maintenance practices in workshops.

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APPENDIX II

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION

ELECTRICAL ELECTRONICS TECHNOLOGY OPTION

QUESTIONNAIRE ON MAINTENANCE PRACTICES OF INSTRUCTORS

IN ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP AND LABORATORIES

IN

POLYTECHNICS IN NIGER STATE

PART 1

Introduction: The main objective of this research is to find out the maintenance practices of instructors in Electrical and Electronics workshop and laboratories in Polytechnics in Niger State. Kindly tick ( ) the column that best appeals to your opinion in the item as the information provided will be highly confidential and strictly used for the purpose of the research.

STATUS OF RESPONDENTS

LECTURER ( ) INSTRUCTOR ( )

PART 2

A guide on how to tick ( ) the questionnaire is shown below. The following rating scale is to be used in indicating your view by ticking the phrase that best portray your level of agreement to the items. The questionnaire items can be related as follows, using the following scale to indicate your thought.

- Very Highly Adopted (VHA) 4 points
- Highly Adopted (HA) 3 points
- Rarely Adopted (RA) 2 points
- Not Adopted (NA) 1 point

NOTE: Please do not tick more than one in a single question.

Research Question 1: What are the preventive maintenance practices adopted by instructors in electrical and electronics workshop in polytechnics in Niger state?

S/NO.	ITEMS	VHA	HA	RA	NA
1.	Regular testing and checking of machines and equipment by workshop instructors.				
2.	Instructors embark on tasks aimed at improving the state of the facility in the polytechnic so as to sustain its utilization and value.				
3.	Regular cleaning of tools, machines and equipment in the workshop and laboratories immediately after use.				
4.	Replacing defective or obsolete machine parts before they reduce the efficiency of the entire equipment.				
5.	Servicing of machines and equipment that are in need of a fine tuning.				
6.	Regular checking of all control lamps, indicators, tachometer, hour meter, etc.				
7.	Instructors' schedules maintenance according to equipment usage.				
8.	Cleaning and lubricating of moving machine parts such as bearings and other contact.				
9.	Switching off machines when taking measurements.				
10.	Ensuring that fragile and highly sensitive laboratory gadget such as oscilloscope is enclosed in a safe place to avoid damage.				

Research Question 2: What are the predictive maintenance practices adopted by instructors in electrical and electronics workshop in polytechnics in Niger state?

S/NO.	ITEMS	VHA	HA	RA	NA
1.	Carrying out conditional- based monitoring to detect potential failures.				
2.	Detecting increase in noise and vibration of equipment when switched on.				
3.	Monitoring signals of equipment light indicators and meters				
4.	Detecting, analyzing and correcting problems before failure occurs.				
5.	Taking remedial actions when conditions deviate from norm				
6.	Improving workers and environmental safety.				
7.	Detecting the onset of a degradation of mechanism to eliminate causal stressor				
8.	Examining whether the systems or part of it will continue to work.				
9.	Eliminating unnecessary shutdown of equipment through predictive measures.				
10.	Analyzing data about deterioration and employing surveillance technology.				

Research Question 3: What are the corrective maintenance practices adopted by instructors in electrical and electronics workshop in polytechnics in Niger state?

S/NO	ITEMS	VHA	HA	RA	NA
1.	Carrying out deferred or planned corrective maintenance on non-critical equipment in the workshop				
2.	Budgeting money for the purpose of addressing unexpected faults or breakdown of critical equipment in the workshop or laboratory				
3.	Restoration of operability to equipment or machine or service breakdown according to the manufacturers to ensure the intended life.				
4.	Always planning the repairs of items or equipment contained in the drafted schedule of work				
5.	Carrying out partial or total replacement of equipment.				
6.	Overhauling critical equipment affecting significantly on operation in the institution.				
7.	Incurring cost on failure of a primary device or system associated with the failure of a secondary device or system.				
8.	Identifying faults or problems that emerge in the workshops and laboratory.				
9.	Carrying out repairs of some items of equipment located in the plants				
10.	Maintenance of equipment that experience unexpected failures as a result of aging, corrosion and unexpected damage.				