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# Development of Electro-Mechanical Contents in Woodwork Machine Maintenance for Capacity Building of Technologists in Nigerian Universities

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**Abstract**

Government of Nigeria has made a significant effort to make sure every Nigerian graduate acquires relevant skills for paid or self employment. Effort made by government recently includes provision of modern machines and equipment for improving skill acquisition among students in technical education programmes. However, effort is less in the area of capacity building of technologists to effectively utilize the machines provided for promoting skills acquisition. Based on this reason, the researchers now carried out the study to develop electro-mechanical contents for capacity building of technologists in woodwork machine maintenance in Nigerian universities. Three research questions guided the study and three null hypotheses formulated were tested at 0.05 level of significance. The study adopted descriptive research design. The area of the study was Enugu State of Nigeria. The population for the study was 203 lecturers of technical education in tertiary institutions and supervisors in relevant industries. There was no sample because of the manageable sizes of the population of subjects. A structured questionnaire titled: Electro-Mechanical Contents in Woodwork Machine Maintenance Questionnaire was used as the instrument for data collection. The instrument was validated by three experts and Cronbach alpha reliability method was adopted to determine the internal consistency of the questionnaire items while 0.84 was obtained. Out of two hundred and three copies of the questionnaire administered on respondents by the researchers, only 187 copies were duly retrieved which represents 93.03 percent return rate. The data collected were analyzed using factor analysis and mean while t-test was used to test the null hypotheses. The findings revealed that 33 contents in form of competencies were determined for capacity building of technologists, 44 instructional strategies for implementing the contents for capacity building of electro-mechanical technologists in Nigerian universities while 33 training facilities and procedures that could be utilized by trainers for building the capacity of technologists in maintaining woodwork machines and equipment were also determined. Recommendations include that technologists should be re-trained using the developed electro-mechanical contents in woodwork machines and equipment

**Keywords:** Electro-mechanical, contents, maintenance, factor analysis, repair, technologists

## INTRODUCTION

The essence of education is to acquire knowledge, skills and right attitudes for well living. Education in Nigeria is structured to be obtained in formal educational institutions such as primary, secondary schools, Colleges of education, Polytechnics and Universities. To acquire knowledge, skills or attitudes, teachers or other supporting staff such as instructors gather their students in classrooms and workshops or laboratories. That is, a classroom or workshop serves as a medium where instruction can be given to group of students in order to learn. In Nigerian universities, various technical and vocational education programmes are offered to interested students. Some of the programmes are automobile, metalwork, electrical/electronic, building and woodwork technology. Generally in these programmes, students are expected to acquire knowledge, skills and attitudes in various occupation areas for either paid or self employment after graduation.

For example, woodwork as one of the technical education programmes offered in Nigerian universities specifically meant to train students for acquisition of relevant knowledge, and skills plus attitudes in making cabinets, furniture, tables and chairs, wardrobes, wooden beds, doors, windows, roofing among others. Woodwork is a technical oriented area of technical education where students are trained to acquire knowledge, technical and practical skills and attitudes for employment. On the other hand, the graduates of this programme are also expected to have dual advantages over their counterparts in other fields of study such as engineering sciences, humanities, social science among others. These graduates are trained teachers for secondary schools and also expected to practise what they have learnt in schools (Bakare, Fittoka & Zakka, 2010). Although the services of the woodwork technology graduates are not limited to teaching and entrepreneurial activities alone, they can also be employed like graduates from different fields of study. All these are prime expectations of government for introducing woodwork technology into the curriculum of Nigerian universities.

In order to achieve all these, Federal Government of Nigeria, World Bank, African Development Bank, STEP-B through Federal Ministry of Education provided the institutions running technical and vocational education programmes with various modern woodwork hand tools, equipment and machines such as lathe machines, band saw, reciprocating machines, jig saw, sander, routers, radial arm, grinding machines, sewing machines, circular saw, drilling machines and portable powered drills for effective training of students who specialized in woodwork technology in Nigerian universities. Shortly after the provision of these machines, only the technologists and technical instructors in woodwork area were trained on how to make use of these modern woodwork machines and equipment for training. How to maintain these machines when situation arises was not part of the training given to the technologists and technical instructors. Moreover, none of the technical instructors or technologists in other relevant areas such as electrical/electronic technology and mechanical technology was trained for effective maintenance of these machines. This is a wide gap to be filled by this study. Ever since then these modern machines and equipment have been in used without effective maintenance and most of them have started breaking down without adequate attention to fix them back to operable state and this situation has really impacted the quality of training given to technical education students who offer courses in woodwork technology area negatively. The school authorities could not easily locate skilled and efficient technicians or technologists who can actually repair and service these faulty machines and equipment thereby making the schools to abandon them for the purchase of new substandard ones. If the faults could be repaired or maintained, it will definitely reduce continuous spending of money and electro- mechanical wastes which can cause health problems such as cancer to people most especially where they are disposed carelessly.

To arrest this situation, the capacity of the technologists and technicians in electrical/electronic and mechanical technology areas of technical education must be built. This is possible because most of the woodwork machines and equipment are the products of electrical/electronic and they are mechanical in nature. These equipment or machines can only be maintained effectively by technologists and technicians who are trained in electrical/electronic and mechanical technology areas. For proper training of these technologists, there must be a training document with good and efficient contents.

Content of a training programme gives directions to the trainers and the trainees. Content as defined by Bakare (2014) is what the teacher and the students pay attention to when they are teaching and learning. Kapoma and Namusokwe (2011) described content as a list of subjects, topics, skills, themes, concepts or works to be covered by teacher and his students. Content of a training programme can be in form of competence, skills, techniques, concepts or attitudes. The contents in this study are the electro-mechanical competencies in woodwork machine maintenance required for capacity building of technologists for effective repair and service of various types of electro-mechanical machines and equipment in wood workshops. Ogwo in Asogwa (2010) explained that competency is characterized by clearly stated, attainable and measurable objectives, followed by identified knowledge, and skills that learners have to master within a given time frame. The contents in woodwork machine maintenance may include: functions of major components of woodwork machines and equipment, symptoms and remedies of faults in machines/equipment, safety precautionary measures for effective maintenance, skills in trouble-shooting, repairing, and servicing of malfunctioned woodwork machines and equipment. These contents if articulated well could be used to build the capacities of technologists in electrical/electronic and mechanical technology for effective maintenance of machines and equipment used in woodwork technology area of technical education in Nigerian Universities. Development of good contents for training makes the training easier and efficient. In the opinion of Quirk (1995), development is the act of making an idea clearer by studying it more, by speaking or writing about it in more detail. Asogwa (2010) viewed development as the act of making something more organized. In the context of this study, development of electro-mechanical contents in woodwork machine maintenance involves: (a) determination of electro-mechanical competencies in woodwork machine maintenance; (b) identification of training facilities and instructional strategies for teaching the contents; (c) organizing what has been identified sequentially and logically in a manner that will make teaching easy for the trainer and trainees and (d) packaging what has been determined and identified and organized into units or modules of instruction with required facilities to constitute a capacity building programme

Capacity building is a deliberate way of improving someone's competency. Capacity building is a process of developing and strengthening the skills, instincts, abilities, process and resources that teachers need for them to survive, adapt and thrive in the fast changing world of technology (Ann, 1996). Capacity building according to Olaitan, Alaribe and Nwobu (2009) is the effort geared towards improving the level of knowledge, skills and attitudes possessed by an individual for proficiency in a given task or job. Capacity building in this study could mean the set of activities directed towards improving competencies and capacities of technologists of electrical/electronic and mechanical technology for maintenance of woodwork machines and equipment. Capacity building of technologists will be meaningful when appropriate facilities are involved. The Organization for Economic Co-operation and Development (OECD) (2013) stated that by adopting relevant technologies for teaching in various tertiary institutions, it will assist the students to acquire 21st century skills as we all know that individuals with poor 21st century skills are more likely to find themselves at risk of unemployment and social exclusion.

Facilities are physical objects that facilitate a given work or activity. Yavala (2011) explained that facilities are those goods and services that help to facilitate teaching and learning process in any performance. Adequate and relevant training facilities make the learning process more satisfying. Facilities may include relevant tools, devices and equipment for teaching and acquiring relevant skills for maintaining woodwork machines and equipment. Various facilities such as sets of screw drivers, infra red rework station, soldering irons, cutting pliers, vacuum cleaners, magnifying desk lamps, fluxes, multi-meters could be used for maintenance of broken down woodwork machines and equipment and implementation of training contents.

Implementation strategies are means of teaching prepared lessons to students. Delivery systems to be selected depend on the contents of the lesson (Bakare, 2014). A good trainer matches the contents of a lesson to delivery systems in order to achieve the objectives of the lesson (Ogbuanya & Bakare, 2017). Application of appropriate implementation strategies or delivery systems improves students' understanding. It enables the students to acquire relevant skills and knowledge. Ezeilo (2001) suggested delivery systems such as seminars, workshops and conferences. Implementation strategies or delivery systems are different teaching methods or techniques and related resources for facilitating the implementation of the contents in woodwork machine maintenance. Both experienced lecturers and supervisors in woodwork industries could help to build the capacity of technologists for effective maintenance of woodwork machines and equipment. The general purpose of the study was to develop electro-mechanical contents for capacity building of technologists in woodwork machine maintenance in Nigerian universities. Specifically the study sought to determine:

1. Electro-mechanical competencies (contents) in woodwork machine maintenance for capacity building of technologists in Nigerian universities
2. Instructional strategies for implementing electro-mechanical contents for capacity building of technologists in Nigerian universities
3. Training facilities and procedures that could be utilized by trainers for building the capacity of technologists in Nigerian universities

**Research questions**

The following research questions were posed:

1. What are the electro-mechanical competencies in woodwork machine maintenance for capacity building of technologists in Nigerian universities?
2. What are the instructional strategies required for implementing electro-mechanical contents for capacity building of technologists in Nigerian universities?
3. What are the training facilities and procedures that could be utilized by trainers for building the capacity of technologists in Nigerian universities?

**Hypotheses**

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

1. There is no significant difference in the mean responses of respondents on the electro-mechanical competencies in woodwork machine maintenance for capacity building of technologists in Nigerian universities
2. There is no significant difference in the mean responses of respondents on the instructional strategies for implementing electro-mechanical contents for capacity building of technologists in Nigerian universities
3. There is no significant difference in the mean responses of respondents on the training facilities and procedures that could be utilized by trainers for building the capacity of technologists in Nigerian universities

## METHODS

The study adopted a descriptive survey design. Descriptive survey design according to Osuala (2005) is a design that studies characteristics and focuses on people, the vital facts of people and their beliefs, opinions, attitude, motivation and behaviors. Descriptive research design according to Kothari and Garg (2014) is appropriate for those studies which are concerned with describing the characteristics of a particular individual, or of a group. The descriptive survey design was therefore adopted for this study because it aimed at using questionnaire to elicit facts, beliefs and opinions of experts about development of electro-mechanical contents for capacity building of technologists in woodwork machine maintenance.

The study was conducted in Enugu State of Nigeria. The population for the study was 203 which comprised lecturers of industrial technical education (i.e lecturers of electrical/electronic technology, woodwork/building technology and automobile/metalwork technology) and supervisors in woodwork industries in Enugu State. There was no sampling because of the manageable size of the population. A structured questionnaire titled: Electro-Mechanical Contents in Woodwork Machine Maintenance Questionnaire (EMCWMMQ) was used for data collection and was on 5-point Likert scale. The structured questionnaire had 139 items developed for collecting data in accordance with the research questions. The instrument was organized in three sections A-C. A centered on electro-mechanical competencies in woodwork machine maintenance for capacity building of technologists, B dealt with Instructional strategies for implementing electro-mechanical contents for capacity building of technologists in Nigerian universities while C centered on training facilities and procedures that could be utilized by trainers for building the capacity of technologists in Nigerian universities. Each item in the instrument was assigned a five response scale of Strongly Agree or Required (SA or SR)-5, Agree or Required (A or R)-4, Undecided (U)-3, Disagree or Not Required (D or NR)-2, and Strongly Disagree or Not Required (SD or SNR)-1point. According to Lozano et al (2008), an instrument can be considered good for validity and reliability if it has between four (4) and seven (7) alternative responses. However, fewer options are acceptable depending on the purpose and scope of the study (Bendig 1954; Mattell and Jacoby 1971; Jones and Scott 2013). The respondents were therefore asked to rank the response options to an item based on the level at which each item was required.

The instrument was face-validated by three experts. These were experts in the Department of Industrial Technical Education, University of Nigeria Nsukka and Department of Art Education. The title of the study, specific purposes, research questions and null hypotheses formulated were attached to each copy of the questionnaire given to the experts. The experts were asked to read the items under each research question and make useful corrections in order to improve the standard of the questionnaire. The experts were also requested to add any relevant item to the questionnaire. After one week, one of the researchers went round to collect the copies of the questionnaire given to the experts and effected the corrections accordingly. One hundred and thirty nine items were retained out of 147 items presented to experts in form of questionnaire.

In other to establish the internal consistency of the questionnaire items, Cronbach Alpha test of internal consistency was conducted on each section in the part 2 of the questionnaire. The researchers administered 20 copies of the structured questionnaire on lecturers of industrial technical education and supervisors in institutions and industries in Anambra State. The reason for administering the copies of the questionnaire on other set of respondents outside the study area was to obtain real reliability coefficient values for each sections of the questionnaire (Roberts, 2012). Statistical Packages for Social Sciences (SPSS) 22 versions was found useful for data analysis. The result of the Cronbach alpha revealed the following: electro-mechanical competencies in woodwork machine maintenance for capacity building of technologists (& = 0.82, n=20), instructional strategies for implementing electro-mechanical contents for capacity building of technologists in Nigerian universities (&= 0.81, n= 20), training facilities and procedures that could be utilized by trainers for building the capacity of technologists in Nigerian universities (&= 0.79, n= 20) while the overall reliability index yielded &= 0.89, n= 20. According to guidelines by Sekaran (2003), a coefficient of .60 is considered to be poor, 0.70 is acceptable, while over 0.80 is good. Olelewe and Agomuo (2016) also stated that the closer the Cronbach's alpha is to 1, the higher the internal consistency.

Out of two hundred and three copies of the questionnaire administered to the respondents by the researchers, only 187 copies were duly retrieved which represent 92.12 percent return rate. Data collected were analyzed using factor analysis and mean for answering the research questions. For selecting the appropriate competencies in woodwork machine maintenance for capacity building of technologists, 0.50 as factor loading was utilized. Any competency with factor loading of 0.50 or above was required and any competency with factor loading less than 0.50 was not required. Also, any item with mean of 3.50 was regarded as required or appropriate while any one with mean below 3.50 was regarded as not required or not appropriate. T-test was employed for testing all the null hypotheses at 0.05 and relevant degrees of freedom. The null hypothesis of no significant difference was accepted for any item whose P-value was greater than the 0.05, but it was rejected for any item whose P-value was less than 0.05.

## RESULTS

The results for the study were obtained from the research questions answered and hypotheses tested through data collected and analyzed. The data for answering research questions and testing hypotheses were presented in Tables 1-3

**Tables I.** Outcome of Factor Analysis for answering Research Question One and t test for Testing Hypothesis One

| S/N | Electro-mechanical competencies | Factor loading at 0.50 | P-values | Remarks, Ho |
|---|---|---|---|---|
| **A** | **Electrical /electronic related competencies** | | | |
| 1 | Identify electro-mechanical relevant hand tools for maintenance of woodwork machines and equipment | 0.95 | 0.53 | **Required, NS** |
| 2 | Trouble shoot occurred fault(s) in various woodwork machines and equipment | 0.60 | 0.34 | **Required, NS** |
| 3 | Remove power unit of stationary machines such as radial arm, band saw, lathe machines, surface plain, reciprocating machine among others | 0.85 | 0.56 | **Required, NS** |
| 4 | Conduct continuity test on power cables of the woodwork powered machines | 0.71 | 0.33 | **Required, NS** |
| 5 | Carry out open and short circuit fault tests on the electrical parts/units of the woodwork machines and equipment | 0.78 | 0.24 | **Required, NS** |
| 6 | Services electrical/electronic units of woodwork powered machines | 0.82 | 0.16 | **Required, NS** |
| 7 | Conduct hot and cold test on powered machines in woodwork | 0.58 | 0.53 | **Required, NS** |
| 8 | Replace bad electrical components in electrical unit of a woodwork machines | 0.56 | 0.41 | **Required, NS** |
| 9 | Identify faulty or bad components in the woodwork machines using appropriate testing instruments | 0.63 | 0.56 | **Required, NS** |
| 10 | Remove bad components from the power units | 0.73 | 0.34 | **Required, NS** |
| 11 | Measure the voltage across the terminal of socket outlets designed to power woodwork machines and equipment | 0.78 | 0.26 | **Required, NS** |

| S/N | Electro-mechanical competencies | Factor loading at 0.50 | P-values | Remarks, Ho |
|---|---|---|---|---|
| 12 | Make use of circuit diagram and instructional manuals when installing or repairing woodwork machines and equipment | 0.82 | 0.31 | **Required, NS** |
| 13 | Select appropriate socket outlet for woodwork stationary powered machines | 0.56 | 0.34 | **Required, NS** |
| 14 | Design standard termination boards for woodwork stationary powered machines based on their capacities | 0.79 | 0.21 | **Required, NS** |
| 15 | Locate standard termination boards for woodwork stationary powered machines at appropriate locations | 0.73 | 0.25 | **Required, NS** |
| 16 | Construct electrical panels for the machines and entire woodwork | 0.67 | 0.12 | **Required, NS** |
| 17 | Install safety devices to secure or protect woodwork machines and equipment | 0.61 | 0.32 | **Required, NS** |
| 18 | Select correct switch gears for woodwork machines and equipment | 0.59 | 0.11 | **Required, NS** |
| 19 | Conduct efficient test on electric motors of the woodwork machines | 0.63 | 0.33 | **Required, NS** |
| 20 | Remove bad electric motors from woodwork machines | 0.62 | 0.23 | **Required, NS** |
| 21 | Replace bad electric motors with another ones | 0.77 | 0.13 | **Required, NS** |
| 22 | Dismantle electric motors for repair or service | 0.60 | 0.21 | **Required, NS** |
| 23 | Re-wind the burnt coils from the electric motors | 0.62 | 0.41 | **Required, NS** |
| 24 | Test run the repaired electric motors | 0.61 | 0.12 | **Required, NS** |
| 25 | Fix/couple back the machines and equipment for effective performance | 0.55 | | |
| **B** | **Mechanical related competencies** | | | |
| 26 | Select appropriate hand tools for clearing mechanical faults in woodwork machines and equipment | 0.68 | 0.54 | **Required, NS** |
| 27 | Identify mechanical faults in woodwork machines and equipment | 0.56 | 0.23 | **Required, NS** |
| 28 | Detect bad mechanical parts in woodwork machines such as radial arm, lathe, band saw, jig saw and reciprocating machines | 0.55 | 0.43 | **Required, NS** |
| 29 | Remove bad or torn sand papers in sander | 0.62 | 0.34 | **Required, NS** |
| 30 | Replace torn sand paper in a sander | 0.59 | 0.43 | **Required, NS** |
| 31 | Identify bad saws in band and circular sawing machines | 0.65 | 0.13 | **Required, NS** |
| 32 | Change bad saws correctly | 0.78 | 0.34 | **Required, NS** |
| 33 | Service each of the woodwork machines and equipment | 0.59 | 0.23 | **Required, NS** |
| 34 | Apply grease or oil to moveable parts of the woodwork machines and equipment | 0.69 | 0.54 | **Required, NS** |
| 35 | Diagnose mechanical faults using various observation technique | 0.56 | 0.23 | **Required, NS** |
| 36 | Change other mechanical parts in various woodwork machines and equipment | 0.66 | 0.11 | **Required, NS** |
| 39 | Carry out repair operations on each of the woodwork machines and equipment | 0.78 | 0.21 | **Required, NS** |

**Keys:** *NS = Not significant, Ho = Hypothesis,*

Data in Table 1 reveal that factor loading of the electro-mechanical competencies in woodwork machine maintenance ranged from 0.50 to 0.95. This indicated that all the 39 competencies could be used as contents for building the capacity of technologists in Nigerian universities for effective maintenance of woodwork machines and equipment. The table also indicated that each item had its P-value greater than 0.05. This showed that there was no significant difference in the mean responses of respondents on the electro-mechanical competencies in woodwork machine maintenance for capacity building of technologists in Nigerian universities. Therefore, the hypothesis of no significant difference was upheld for the 39 electro-mechanical competencies in woodwork machine maintenance.

**Tables II.** Mean Responses of the Respondents on the Instructional Strategies for implementing the Electro-mechanical Contents for Capacity Building of Technologists

| S/N | Instructional strategies | Mean | S.D. | P-values | Remarks, Ho |
|---|---|---|---|---|---|
| 1 | Using of power point/projector for lecture delivery | 3.98 | 0.77 | 0.53 | **Required, NS** |
| 2 | Learning by doing | 3.76 | 0.79 | 0.34 | **Required, NS** |
| 3 | Compact disc and cassettes in presentation | 3.85 | 0.81 | 0.56 | **Required, NS** |
| 4 | Audio-visual materials/objects | 3.80 | 0.89 | 0.33 | **Required, NS** |
| 5 | Films and videos in delivering lectures | 3.78 | 0.83 | 0.24 | **Required, NS** |
| 6 | Workshops on woodwork machine/equipment maintenance | 3.82 | 0.86 | 0.16 | **Required, NS** |
| 7 | Group dynamic | 3.58 | 0.85 | 0.53 | **Required, NS** |
| 8 | Adoption of dualised training | 3.50 | 0.89 | 0.41 | **Required, NS** |
| 9 | Using internet as a means of instruction delivery | 3.63 | 0.82 | 0.56 | **Required, NS** |
| 10 | Questioning technologists about what they know | 3.80 | 0.80 | 0.34 | **Required, NS** |
| 11 | Interactive lecture | 3.78 | 0.71 | 0.26 | **Required, NS** |
| 12 | Use of practice teaching | 3.82 | 0.93 | 0.31 | **Required, NS** |
| 13 | Prepare and deliver skills to be taught to students in slides | 3.56 | 0.81 | 0.34 | **Required, NS** |
| 14 | Deliver lectures inform of film show to technologists | 3.79 | 0.84 | 0.21 | **Required, NS** |
| 15 | Simulation as teaching strategy | 3.73 | 0.88 | 0.25 | **Required, NS** |
| 16 | Tape recorders to instruct technologists | 3.67 | 0.72 | 0.12 | **Required, NS** |
| 17 | Using flow charts when instructing trainees | 3.61 | 0.80 | 0.32 | **Required, NS** |
| 18 | Using different types of film shows for instruction delivery | 3.55 | 0.70 | 0.11 | **Required, NS** |
| 19 | Using circuit diagrams of different types of machines for training | 3.66 | 0.82 | 0.42 | **Required, NS** |
| 20 | Using scraps of different types of machines | 3.95 | 0.73 | 0.53 | **Required, NS** |
| 21 | Small hands-on group training | 3.76 | 0.79 | 0.34 | **Required, NS** |
| 22 | Evidenced based learning | 3.85 | 0.71 | 0.56 | **Required, NS** |
| 23 | Using large group training | 3.80 | 0.90 | 0.33 | **Required, NS** |
| 24 | Conversation with questions posed to elicit thoughtful responses from learners | 3.78 | 0.83 | 0.24 | **Required, NS** |
| 25 | Verbal instructions | 3.82 | 0.86 | 0.16 | **Required, NS** |
| 26 | Using photo sequences | 3.58 | 0.85 | 0.53 | **Required, NS** |
| 27 | Picture/images of different types of machine and equipment | 3.50 | 0.89 | 0.41 | **Required, NS** |
| 28 | Film viewing | 3.63 | 0.81 | 0.56 | **Required, NS** |
| 29 | Dual training | 3.80 | 0.81 | 0.34 | **Required, NS** |
| 30 | Group dynamic | 3.78 | 7.00 | 0.26 | **Required, NS** |
| 31 | Distance learning | 3.82 | 0.93 | 0.31 | **Required, NS** |
| 32 | Self paced learning | 3.56 | 0.81 | 0.34 | **Required, NS** |
| 33 | Simulation | 3.79 | 0.84 | 0.21 | **Required, NS** |
| 34 | Action plan preparation and presentations | 3.73 | 0.88 | 0.25 | **Required, NS** |
| 35 | Symposium | 3.67 | 0.71 | 0.12 | **Required, NS** |
| 36 | Individual and small group work and presentations | 3.61 | 0.80 | 0.32 | **Required, NS** |
| 37 | Experience sharing | 3.55 | 0.70 | 0.11 | **Required, NS** |
| 38 | Story analysis | 3.66 | 0.82 | 0.42 | **Required, NS** |
| 39 | Brainstorming | 3.95 | 0.71 | 0.53 | **Required, NS** |
| 40 | Inquiry based learning | 3.76 | 0.79 | 0.34 | **Required, NS** |
| 41 | Seminar | 3.85 | 0.81 | 0.56 | **Required, NS** |
| 42 | Group Exercises | 3.80 | 0.90 | 0.33 | **Required, NS** |
| 43 | Webinar | 3.78 | 0.83 | 0.24 | **Required, NS** |

| S/N | Instructional strategies | Mean | S.D. | P-values | Remarks, Ho |
|---|---|---|---|---|---|
| 44 | Debate | 3.82 | 0.86 | 0.16 | **Required, NS** |
| 45 | Cooperative learning | 3.58 | 0.85 | 0.53 | **Required, NS** |
| 46 | Project based learning | 3.50 | 0.89 | 0.41 | **Required, NS** |
| 47 | Action based learning | 3.63 | 0.81 | 0.56 | **Required, NS** |
| 48 | Challenge based learning | 3.80 | 0.81 | 0.34 | **Required, NS** |
| 49 | Activity based learning | 3.78 | 0.76 | 0.26 | **Required, NS** |
| 50 | Project method | 3.82 | 0.93 | 0.31 | **Required, NS** |
| 51 | Cognitive apprenticeship instructional method | 3.67 | 0.71 | 0.12 | **Required, NS** |
| 52 | Guided discovery method | 3.64 | 0.80 | 0.32 | **Required, NS** |
| 53 | Panel discussion | 3.55 | 0.70 | 0.11 | **Required, NS** |
| 54 | Learning mode | 3.50 | 0.82 | 0.42 | **Required, NS** |
| 55 | Meta-learning | 3.95 | 0.71 | 0.53 | **Required, NS** |
| 56 | Reciprocal peer tutoring | 3.76 | 0.79 | 0.34 | **Required, NS** |
| 57 | Programmed instructional method | 3.85 | 0.83 | 0.56 | **Required, NS** |

**Keys:** *S.D. = Standard Deviation, NS = Not significant, Ho = Hypothesis, Sig. = significance*

Data in Table 2 reveal that 57 items had their mean values ranged from 3.50 to 3.98 and this shows that the mean value of each item was above the cut-off point of 3.50, indicating that all the 57 instructional strategies were required for implementing electro-mechanical contents for capacity building of technologists in Nigerian universities. The Table also shows that the standard deviations of the items were within the range of 0.70 to 0.90; this indicated that the respondents were not far from the mean and one another in their responses. The Table 2 also indicated that all the items had their P-values greater than 0.05 which means that there was no significant difference in the mean responses of the respondents on the instructional strategies for implementing electro-mechanical contents for capacity building of technologists in Nigerian universities. Therefore, the null hypothesis of no significant difference was upheld for all the 57 instructional strategies

**Tables III.** Mean Responses of the Respondents on the Training Facilities that could be utilized by Trainers for Building the Capacity of Technologists

| S/N | Training facilities | Mean | S.D. | P-values | Remarks, Ho |
|---|---|---|---|---|---|
| 1 | Conducive workshop/classrooms for training | 3.73 | 0.70 | 0.53 | **Required, NS** |
| 2 | Constant electricity/power supply | 3.60 | 0.72 | 0.34 | **Required, NS** |
| 3 | Internet facilities for downloading relevant materials during training | 3.81 | 0.84 | 0.56 | **Required, NS** |
| 4 | Ultrasonic cleaner | 3.80 | 0.85 | 0.33 | **Required, NS** |
| 5 | Interactive white board | 3.77 | 0.83 | 0.24 | **Required, NS** |
| 6 | Projector | 3.80 | 0.86 | 0.16 | **Required, NS** |
| 7 | Computer systems | 3.58 | 0.85 | 0.53 | **Required, NS** |
| 8 | Power soldering iron | 3.56 | 0.89 | 0.41 | **Required, NS** |
| 9 | Soldering lead | 3.63 | 0.78 | 0.56 | **Required, NS** |
| 10 | Soldering paste | 3.78 | 0.88 | 0.09 | **Required, NS** |
| 11 | Pickers for removing tiny and hidden objects from the machines | 3.86 | 0.80 | 0.34 | **Required, NS** |
| 12 | Torque screw driver/precision tools | 3.78 | 0.84 | 0.26 | **Required, NS** |
| 13 | Eyelets and eye letting tools | 3.82 | 0.79 | 0.31 | **Required, NS** |
| 14 | Hot lead sucker/suction devices for removing melted solder | 3.56 | 0.82 | 0.34 | **Required, NS** |
| 15 | Long nose pliers for holding tiny object in hidden place | 3.77 | 0.84 | 0.21 | **Required, NS** |
| 16 | Cutting pliers for cutting flexible objects | 3.75 | 0.87 | 0.25 | **Required, NS** |

| S/N | Training facilities | Mean | S.D. | P-values | Remarks, | Ho |
|---|---|---|---|---|---|---|
| 17 | Multi-testers for testing components and measuring electrical quantities | 3.58 | 0.85 | 0.53 | **Required,** | **NS** |
| 18 | Fluxes (Non-corrosive liquid flux) to prevent oxidation during soldering | 3.55 | 0.89 | 0.41 | **Required,** | **NS** |
| 19 | Solder-resistant paint used in soldering | 3.63 | 0.78 | 0.56 | **Required,** | **NS** |
| 20 | Magnifying lens for enlarging tiny objects | 3.78 | 0.88 | 0.09 | **Required,** | **NS** |
| 21 | Magnifying desk lamp | 3.86 | 0.80 | 0.34 | **Required,** | **NS** |
| 22 | Portable plainer | 3.78 | 0.84 | 0.26 | **Required,** | **NS** |
| 23 | Powered screw drivers | 3.82 | 0.79 | 0.31 | **Required,** | **NS** |
| 24 | Drilling machine | 3.56 | 0.82 | 0.34 | **Required,** | **NS** |
| 25 | User manuals | 3.77 | 0.84 | 0.21 | **Required,** | **NS** |
| 26 | Screw extractors | 3.75 | 0.87 | 0.25 | **Required,** | **NS** |
| 27 | Radial arms | 3.58 | 0.85 | 0.53 | **Required,** | **NS** |
| 28 | Reciprocating machines | 3.59 | 0.89 | 0.41 | **Required,** | **NS** |
| 29 | Band saw | 3.63 | 0.78 | 0.56 | **Required,** | **NS** |
| 30 | Lathe machines | 3.78 | 0.88 | 0.09 | **Required,** | **NS** |
| 31 | Surface plainer | 3.86 | 0.80 | 0.34 | **Required,** | **NS** |
| 32 | Circular saw | 3.78 | 0.84 | 0.26 | **Required,** | **NS** |
| 33 | Jig saw | 3.82 | 0.79 | 0.31 | **Required,** | **NS** |
| 34 | Sewing machines | 3.52 | 0.82 | 0.34 | **Required,** | **NS** |
| 35 | Portable sanders | 3.77 | 0.84 | 0.21 | **Required,** | **NS** |
| 36 | Router | 3.75 | 0.87 | 0.25 | **Required,** | **NS** |
| 37 | Grinding machines | 3.58 | 0.85 | 0.53 | **Required,** | **NS** |
| 38 | Portable drills | 3.57 | 0.89 | 0.41 | **Required,** | **NS** |
| 39 | Various types of electric motors | 3.63 | 0.78 | 0.56 | **Required,** | **NS** |
| 40 | Spanners | 3.58 | 0.85 | 0.53 | **Required,** | **NS** |
| 41 | Distribution fuse board | 3.53 | 0.89 | 0.41 | **Required,** | **NS** |
| 42 | Switch gears | 3.63 | 0.78 | 0.56 | **Required,** | **NS** |
| 43 | Socket outlets for machines and equipment | 3.78 | 0.81 | 0.09 | **Required,** | **NS** |

**Keys:** *S.D. = Standard Deviation, NS = Not significant, Ho = hypothesis, Sig. = significance*

Data in Table 3 revealed that 43 items had their mean values ranged from 3.52 to 3.86 and this shows that the mean value of each item was above the cut-off point of 3.50, indicating that all the 43 training facilities could be utilized by trainers for building the capacity of technologists in Nigerian universities. Similarly, the standard deviation of contents of the training programme ranged from 0.70 to 0.89 indicating that the respondents were close to one another in their opinion. The Table 3 also indicated that all the items had their P-values greater than 0.05. This indicated that there was no significant difference in the mean responses of the respondents on the training facilities that could be utilized by trainers for building the capacity of technologists in Nigerian universities. Therefore, the null hypothesis of no significant difference was upheld for all the 43 training facilities

## DISCUSSION OF FINDINGS

The findings of this study revealed 39 competencies (contents) in woodwork machine maintenance for capacity building of technologists, 57 instructional strategies for implementing the contents for capacity building of technologists and 43 training facilities that could be utilized by trainers for building the capacity of technologists. The contents of a training programme determine the quality of skills acquired by the trainees. The results of the study in Table 1 agreed with Giachino and Gallington (1977) that if content has no components of non – loading items, it is assumed that the factorial validity of the content is high. The finding also agreed with the opinion of Jain (2010) that the higher the absence of low loading items the more important and suitable the contents. The finding was in agreement with the opinion of Kapoma and Namusokwe (2011) that content is a list of subjects, skills, topics, themes, concepts or works to be covered in a programme. Equipping teachers of technology such as technologists and instructors with necessary contents during retraining promotes skills acquisition among students; because these teachers are charged with the responsibility of equipping students with relevant skills and attitudes in occupational areas of technical education in schools and colleges

These findings were in agreement with the findings of Ogbuanya and Bakare (2017) who that 22 competencies in e-teaching were appropriate for capacity building of technical education lecturers, 44 instructional strategies for implementing e-teaching contents for capacity building of technical education lecturers and 33 training facilities and procedures for building the capacity of technical education lecturers in e-teaching. The findings of this study agreed with the findings of Asogwa (2010) who conducted a study on development of entrepreneurial competency support programme in goat production for enhancing the income of teachers of agriculture in secondary in Enugu State and found that 11 competency items were required in planning for goat production, 17 in providing housing, 29 in breeding goat, 29 in rearing weaned goats, six in health management of goats, 10 in marketing of goats and 27 in packaging competency items in goat production enterprise into a competency based programme. This finding was also in agreement with the study of Akinduro (2006) who carried out a study on electrical installation and maintenance work skills needed by technical college's graduates to enhance their employability in Ondo State. The author found out that the graduates of technical colleges needed domestic installation skills, industrial installation skills, cable jointing skills, battery charging skills and winding skills in electrical machine for employment in Ondo State. The findings of this study agreed with the findings of Ogbuanya, and Bakare (2014) who conducted a study on mechatronics skills required for integration into electrical/electronic engineering technology programme in polytechnics for sustainable employment of graduates in contemporary Nigeria. The findings revealed that 16 mechatronicc contents and 40 mechatronics skills were required for integration into electrical/electronic engineering technology programme in polytechnics for sustainable employment of graduates. This finding was in agreement with the findings of Nwachukwu, Bakare and Jika (2011) who carried out a study to identify effective laboratory safety practice skills required by electrical and electronics students for effective functioning in the laboratory of technical colleges in Ekiti State. The authors found that 10 safety practice skills were required to use electrical hand tools, 25 safety practice skills in operating electrical and electronic power tools and machines and 10 safety practice skills for working in electrical/electronic workshop.

The results of the study in Table 2 show that all the instructional strategies could be used for implementing the contents of the capacity programme. These findings agreed with the finding of Olelewe and Okwor (2017) that using ICT supported strategies for teaching improves learning outcome of students and make the teaching easier for teachers. The findings were in agreement with the finding of Onah (2013) who carried out a study on development of a digital empowerment programme for students on e-learning in the universities in southeast of Nigeria and found out that demonstration, cooperative learning, discussion and guided discovery are suitable as instructional strategies for teaching competence to students. Teaching strategies/ methods serve as medium in which teachers transfer their planned instruction to students. Also the finding were in consonance with the findings of Ogbuanya, Bakare and Igweh (2009) that teaching strategies such as reciprocal peer tutoring improve someone's competence in electrical/electronic and other related subjects when effectively applied during instruction

The results of the study in Table 3 show that all the training facilities could be used for implementing the contents of the capacity programme. These findings were are also in line with the finding of Adirika and Alike (2008) that technologies such as computer, relevant electronic equipment, internet facilities, email, cell phones, e-teaching facilities, Ipads among others are yet to be fully used for teaching of school subjects due to inadequate skill possessed by the lecturers.

Furthermore, the results of hypotheses one to three showed that there were no significant differences in the mean responses of lecturers and supervisors on the contents, instructional strategies and training facilities for capacity building of technologists in woodwork machines maintenance. This means that the lecturers and supervisors had similar perceptions on the contents, instructional facilities and training facilities for capacity building. That is, they have the same opinions on most of the items presented Tables 1-3.

## CONCLUSION

One of the objectives of Technical education in Nigerian universities is to equip students with skills and workplace attitudes for effective performance on graduation. Personnel such as technical instructors, lecturers and technologists are involved in realizing the laudable objectives of technical education. Federal Government of Nigeria through her agencies supplies schools and colleges with relevant machines and equipment for effective training of students in different areas of technical education such as automobile/metalwork, electrical/electronic, building/woodwork technology. The technologists who are supposed to make use and maintain these machines and equipment for training of their students could not effectively utilize them due to shortage of skills and right attitudes. The institutions find it difficult to locate efficient technologists and technicians who can actually repair or service these machines when they are bad. The researchers now carried out a study in order to provide everlasting solution to Shortcomings of technologists and other supporting officers. The purpose of the study was to develop electro-mechanical contents for capacity building of technologists in woodwork machine maintenance in Nigerian universities. Three research questions were answered: one was to determine the electro-mechanical competencies (contents) in woodwork machine maintenance for capacity building of technologists in Nigerian universities, second was to Instructional strategies for implementing electro-mechanical contents for capacity building of technologists in Nigerian universities and the third one was to determine the training facilities and procedures that could be utilized by trainers for building the capacity of technologists in Nigerian universities. In order to answer these questions, a 139-item self-structured questionnaire was developed as the research instrument for data collection, and was administered to 203 participating specialists from various institutions in Enugu State of Nigeria. In conclusion, the experts determined relevant contents in woodwork machine maintenance and also identified instructional strategies and training facilities for building the capacities of technologists in Nigerian universities.

## RECOMMENDATIONS

Based on the findings of this study, the researchers presented the following recommendations for consideration:

1. The technologists and technical instructors should be re-trained using the developed contents in woodwork machine maintenance
2. Relevant facilities and materials should be supplied by government and enabling individuals for the implementation of the developed contents in woodwork machine maintenance

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