STRATEGIES FOR IMPROVING MAINTENANCE OF LABORATORIES EQUIPMENT FOR EFFECTIVE SERVICE DELIVERY IN UNIVERSITIES IN ABIA STATE

Adaku Umeh-Idika & Okpala Jennifer.
Home Science Department.
Michael Okpara University of Agriculture Umudike

Abstract
This study focused on strategies for improving maintenance of laboratories equipment in universities in Abia State for effective service delivery. The following objectives guided the study; identify the effective preventive maintenance strategies for improving maintenance of laboratories equipment; identify the effective corrective maintenance strategies for improving the maintenance of laboratories equipment among others. Four research questions guided the study; one null hypothesis tested at 0.05 level of significance using T-test was also adopted. The study adopted a descriptive survey design. The population was made up of all technical staff of the institutions which is 245. The sample size was the 245 technical staff which was selected for the study. Instrument for data collection was the questionnaire. Data were analyzed using mean, standard deviation and t-test statistics. The findings revealed the following seven (7) preventive maintenance and seven (7) effective corrective maintenance strategies among others Recommendations were proffered based on the findings: Competent laboratory attendants should be employed in order to implement maintenance culture in the institutions. All laboratory attendants should be sent for equipment maintenance training through workshops, seminars and conferences periodically.

Keywords: Strategies, Maintenance, Laboratories, Equipment and Service Delivery.

Introduction
Laboratory equipment are portable or heavy mechanical devices for practical oriented course operation in the laboratory, workshop or field laboratory. Olaitan (2015) observed that the use of equipment is mainly on technically specialized skill practices in the instructional and learning situations. It is used for scientific research and takes many forms because of the differing requirements of specialists in the various fields of science and engineering. Scientific laboratories can be found in research rooms in schools and universities, which are used to perform an experiment, take measurements and also collect data. Thus, ineffective teaching of practical oriented courses in tertiary institutions is to a large extent as result of lack of maintenance culture. Dervistotis (2011) stated that poor maintenance can result in defective output, unsafe working condition and increased production cost due to repairs and excessive downtime. Uzoagulu (2011) noted that functionality of laboratory equipment, tools and facilities and their availability could only be ensured through prompt maintenance. Uzoagulu (2011) stated that laboratory equipment must be utilized to give training and impart requisite practical skills and technical knowledge.

However, to be able to achieve the goal of practical oriented education, there must be adequate facilities such as laboratories and equipment for its teachings and learning skills, knowledge and competencies at the tertiary level. Vocational and technical education include training in engineering such as Electrical, Mechanical, Welding and Fabrication, Agricultural, science laboratories, computer science, other courses include office technology, food technology hospitality, business administration, accountancy and so on. These courses are taught at colleges of education, polytechnics and the universities. Olaintan (2015) attributed the inability to maintain machines to the following factors: most establishments have erroneous conception of maintenance as a task for technicians alone, lack of personnel with adequate maintenance principles, utilization of technology which root lies in other culture, absence of record system and inability to support innovations in the departments and lack of funds to procure spare parts. University of Nigeria maintenance committee report (2016) stated that there is an alarming growth of non-functioning...
laboratory and workshop equipment in the area of science and technology. This has resulted in ineffective teaching of practical course since a large proportion of equipment existing in the workshop do not function as required. Effectiveness is an indication of the impact of group of activities performed on the achievement of the intended learning outcomes. Olaitan (2015) stated that effectiveness of maintenance refers to the extent to which maintenance objectives are met as regards the satisfactions of both internal, external and customer requirements. It is imperative that good operating equipment, tools and facilities will enhance effective maintenance system. Effective maintenance measures would eventually culminate in the retirement and replacement of the equipment and facilities. One basic requirement needed for equipment and facilities maintenance is the provision of direction for effective maintenance programme of instructional equipment in Home Economics workshop and laboratory. There is need to keep instructional equipment in good working order, until it attains its maximum possible life span. Effective maintenance of workshop equipment that can make science education reach the level of high productivity and make the teaching and learning to be more effective is necessary since very few equipment and tools were supplied to the schools.

Maintenance aims at keeping equipment, tools and other assets in the condition that best facilitates organizational goals. It is a way of repairing or servicing used equipment in order to make for enhanced functioning. In the opinion of Gelberg (2014) maintenance is a systematic care and attention required to keep equipment in good working order. Gelberg (2014) further stressed that, in the industry, general system of planned or scheduled preventive maintenance is used not only to keep equipment at its high rates productivity and original accuracy, but also to ensure full and uninterrupted service. To ensure maximum availability and reliability of the existing facility, regular maintenance must be carefully planned and religiously carried out to minimize delays and stoppages due to insufficient performance and breakdown of these facilities. To ensure maximum functioning of equipment, designing of effective maintenance measures are required. The effectiveness of any tool or equipment in performing specific function depends on the maintenance measures adopted. According to Ogbuanya (2011) the development of a strategy for maintenance involves a range of structural decision which includes what to be maintained, how maintenance is going to be performed, who performs the maintenance, what range of skills are involved and when should the equipment be maintained? This is one of the ways of planning for maintenance activity in advance by the practical oriented course personnel. Hence the implementation of maintenance measures will require human resources. The measures will be based on definite cooperative focus while the functionality of the element depend on factors like qualification, motivation, interpretation, relationship, training and retraining.

Maintenance strategies involve predictive maintenance, preventive maintenance and corrective maintenance (Adeniyi, Hori & Sanni, 2004). Predictive maintenance is a maintenance which takes place when there is a warning signal of danger in the operation of equipment. It is concerned with the application of useful strategies to forestall a breakdown when danger signals are observed. According to Orikpe (2011), predictive maintenance involves watching out for danger signal such as unusual noise, danger light indicators, inefficiency of performance and arresting the situation promptly before there is any major breakdown. The author further pointed out that it may involve minor errors which could be corrected by replacement of parts. Preventive maintenance is a type of maintenance or practice that involves inspection, lubrication, cleaning and testing of an equipment or facility used in factory or laboratory. Wild (2015) stated that preventive maintenance is used to delay the breakdown of equipment, and also reduce the severity of any breakdown that might occur. The author noted that servicing as routine cleaning, lubrication and adjustment may significantly reduce wear and prevent breakdown. Corrective maintenance is a work carried out to restore (including adjustment and repair) an asset that has ceased to meet standards. Corrective maintenance is employed when there is malfunctioning or complete breakdown of the equipment. Similarly, Swoden (2010) defined corrective maintenance as a work or action needed to restore the integrity of damage or deteriorated structure and it includes the repair or replacement of defective parts.

An effective education service delivery can only be offered when equipment, tools and facilities are continuously maintained. Each of them needs to be in a good condition at all times to enhance the student’s training. Various maintenance measures
should be employed to ensure efficient and effective servicing of equipment in order to keep them in operation and to eliminate preventable breakdown. On the other hand, strategies offer a framework within which an organization or individual defines possible means of achieving its goals and objectives. Swanso (2006) described strategy as a well-planned series of action, for achieving an aim especially success against an opponent. In the light of Summers (2009) definition of strategy, specialist in the area automobile technology then needs to package a well-planned action to arouse and improve students interest) to achieve success in the discipline. For effective maintenance services, Ezeji (2016) observed that a good start will be from making judicious use of the available materials and improvising local alternatives to imported materials with a view to ultimately indigenizing the production of the technical equipment. The author indicated that several facilities used for technical training require constant lubricants; they need to be maintained through constant cleaning. It needs also to be tested to identify the effective parts, care being taken in their use and repairs affected where necessary. Some tools, facilities and equipment in the schools are not properly cared for. Poor co-ordination and many more of the interactive human element leads to failure of many maintenance services and subsequently poor service delivery in the teaching and learning in the tertiary institutions. Hence, the need to identify the strategies for improving maintenance of laboratories equipment in tertiary institutions cannot be over emphasized.

Statement of the Problem
The problem of the study is that if the maintenance culture is not checked it will caused the institutions to produce students without practical saleable skills and half-baked graduates. The laboratory equipment, tools and facilities in the science workshop and laboratory are meant for the acquisition of practical skills by students. However, Proper maintenance of these equipment is of great importance for achieving its stipulated science oriented course objectives. Practical skills cannot be effectively impacted theoretically and that laboratories, equipment and tools are very much required in the training for practical skill acquisition. However, Ogbuanya (2011) observed that government in realization of the importance of tools, equipment and laboratories in skill training and scientific knowledge has provided funds for tools, equipment and laboratories at the secondary and tertiary institutions in Nigeria. In spite of the huge financial commitment of government in the provision of laboratories, tools and equipment Anyakoha (2004) stated that these equipment, tools and laboratories lack maintenance. The unfortunate and regrettable state of equipment tools and laboratories have been attributed to inability of the operators to apply preventive and total maintenance culture as at when due, on the equipment tools and laboratories. Maintaining tertiary institutions as regards to its laboratory equipment requires very high capital outlay particularly in form of building, equipment and other infrastructural facilities. Equipping tertiary institutions with workshop laboratory equipment has remained problematic because of its capital intensive nature.

Despite the fact that tertiary institutions workshop equipment are very expensive and in short supply for effective service delivery programmes, it is wise and necessary that whatever laboratory equipment and tools available should be properly maintained. Based on the above background, evidence still show that there are no proper measures for maintenance of laboratory equipment in the study area. Hence the study addressed the problem of poor maintenance culture at the tertiary level by identifying strategies for improving maintenance of laboratories equipment of universities. Using Abia state for effective service delivery in tertiary institutions.

Purpose of the study:
The main purpose of this study was to determine the strategies for improving maintenance of laboratories equipment in Abia State for effective service delivery. Specifically, the study intends to:
1. Identify the effective preventive maintenance strategies for improving maintenance of laboratories equipment.
2. Identify the effective correction maintenance strategies for improving maintenance of laboratories equipment.
3. Identify problems affecting the effective maintenance of laboratory equipment.
4. Find out how the problems affecting the effective maintenance of laboratory equipment could be remedied.
Research questions:
The following research questions guided the study:
1. What are the effective preventive maintenance strategies for improving maintenance of laboratories?
2. What are the effective correction maintenance strategies for improving maintenance of laboratories equipment
3. What are the problems affecting the effective maintenance of laboratory equipment
4. How can the problems affecting the effective maintenance of laboratory equipment be remedied.

Research Hypothesis:
The hypothesis was tested at 0.5 level of significance using t-test.
1. There is no significant difference in the mean ratings of MOUAU technical staff and ABSU technical staff on the effective maintenance strategies for improving maintenance of laboratories equipment.

Methodology:
Research Design of the Study:
This work adopted a descriptive survey design. Nworgu (2016) explained a descriptive survey design as one in which a group of people or items is studied by collecting and analyzing data from a few people or items considered to be representative of the entire group. Since data will be collected through the use of questionnaire, the descriptive survey design is therefore, appropriate for the study

Area of the Study:
The study was delimited to the two Universities in Abia State. The area is about 6,320km² (square km) with a population of 130,931 at the 2006 census. It is a State of the South East geopolitical zone of Nigeria, bordered to the North and North East by the states of Enugu and Ebonyi, Imo State to the West, Cross Rivers State to the East, Akwa Ibom to the South East and Rivers State to the South.

Population for the Study:
The population for the study comprised of all the laboratories located at MOUAU and ABSU numbering about 71 and 57 laboratories respectively. However, all the technical staff in the two Universities in Abia state, numbering about 245 technical staff i.e. 178 staff(MOUAU) and 67 staff (ABSU)-(MOUAU and ABSU, personnel unit 2019) were selected for the study.

Sample and Sampling Technique:
There was no sampling for the study since the population for the study can be managed, hence the whole population was used.

Instrument for Data Collection:
Questionnaire titled: Strategies for Improving Maintenance of Laboratories Equipment of universities (SFIMLE)” was used as instrument for data collection for this study. SFIMLE elicited information from the technical staff on the strategies for improving maintenance of laboratories equipment of universities. Both questions were based on the literature reviewed.

Validation of the Instrument:
The instrument for data collection was face validated. The initial draft of the instrument was submitted to three experts: two in Home Economics Department and one in measurement and evaluation-all in Michael Okpara university of Agriculture, Umudike. These experts subjected the instrument to rigorous scrutiny in order to ascertain the clarity, relevance, adequacy and other attributes which a good research instrument should possess. The researcher reconstructed the instrument based on the suggestions of the experts.

Method of Data Collection:
In view of the population of the respondents of the study, the researcher made used of two research assistants for the study. The researcher briefed the research assistants on the objective of the study. This enabled them explain certain items on the questionnaire to the respondents so that the questionnaire would be properly filled. The questionnaire were administered by the researcher and the research assistants to the respondents and were collected on the spot.

Data Analysis:
The data collected were analyzed using mean, standard deviation and t-test statistics. The mean was used to answer the research questions. A Likert mean of 3.50-4.49 was accepted as strongly agree, 2.50-2.49 was accepted while 1.50-2.49 was rejected. Any mean response of 3.00 and above was considered positive while any mean response below 3.00 was considered negative. For hypothesis testing, the null hypothesis for any item was rejected when the calculated t-value is less than the t- table value of 1.96 but was accepted when the calculated t-value is higher than or equal to the table value of 1.96.
Findings of The Study:

Table 4.1 Questionnaire Return Rate

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Distributed</td>
<td>245</td>
<td>100</td>
</tr>
<tr>
<td>Number Retrieved</td>
<td>245</td>
<td>100</td>
</tr>
<tr>
<td>Number Missing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>245</td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>


**Findings:**

The following findings were made:
1. 7 Effective preventive strategies were found.
2. 7 Effective corrective maintenance strategies were found.
3. 7 Problems affecting effective maintenance of laboratories equipment were found.
4. 7 Ways of remedying the problems were also found.

Table 4.2; Analysis of the responses on the effective preventive maintenance strategies for improving maintenance of laboratories equipment N=245

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>Mean</th>
<th>SD</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Routine care for laboratory equipment such as clearing and lubricating are carried out on daily basis</td>
<td>3.27</td>
<td>.03</td>
<td>Agreed</td>
</tr>
<tr>
<td>2</td>
<td>Laboratory personnel should instruct students on the proper method to recognized faulty laboratory equipment by differentiating between proper functioning and faculty equipment.</td>
<td>3.32</td>
<td>.87</td>
<td>Agreed</td>
</tr>
<tr>
<td>3</td>
<td>Students assist in clearing and servicing of laboratory equipment and facilities</td>
<td>2.57</td>
<td>.76</td>
<td>Agreed</td>
</tr>
<tr>
<td>4</td>
<td>Laboratory personnel carryout periodic inspection on each equipment and facilities to observe damage, overstressed parts that need adjustment.</td>
<td>2.77</td>
<td>.87</td>
<td>Agreed</td>
</tr>
<tr>
<td>5</td>
<td>Adjustment and replacement of disposable parts are carried out on regular basis</td>
<td>2.73</td>
<td>.32</td>
<td>Agreed</td>
</tr>
<tr>
<td>6</td>
<td>Seminars, workshop and conferences are organized periodically on maintenance.</td>
<td>3.32</td>
<td>.87</td>
<td>Agreed</td>
</tr>
<tr>
<td>7</td>
<td>Teachers and students refers to servicing manual when maintaining laboratory equipment.</td>
<td>2.57</td>
<td>.76</td>
<td>Agreed</td>
</tr>
</tbody>
</table>

**Pooled Mean(X): 2.94 Strongly Agree**

Table 2; shows that the pooled mean rating of technical staff in the items are above the mean benchmark of 2.50. These however indicates agreed. Therefore, the pooled mean of 2.94 shows that the technical staff have a positive agreement on the identified effective preventive maintenance strategies for improving maintenance of laboratories equipment.
Table 4.3; Analysis of the responses on the effective correction maintenance strategies for improving maintenance of laboratories equipment N=245

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>Mean</th>
<th>SD</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecturer acquired training from manufacturer of equipment before operating them</td>
<td>3.28</td>
<td>1.10</td>
<td>Agreed</td>
</tr>
<tr>
<td>2</td>
<td>Arrangement are made for servicing equipment and facilities after 3.05 use</td>
<td>3.05</td>
<td>0.98</td>
<td>Agreed</td>
</tr>
<tr>
<td>3</td>
<td>Routine maintenance exercise such as oiling, greasing and cleaning of equipment and facilities is carried out by students under close supervision.</td>
<td>3.10</td>
<td>1.00</td>
<td>Agreed</td>
</tr>
<tr>
<td>4</td>
<td>Schedule of duty is used to enable students to actively participate in the maintenance of laboratory equipment for future work.</td>
<td>3.10</td>
<td>1.00</td>
<td>Agreed</td>
</tr>
<tr>
<td>5</td>
<td>Ensure that moving parts are always well lubricated or greased after work</td>
<td>3.11</td>
<td>0.90</td>
<td>Agreed</td>
</tr>
<tr>
<td>6</td>
<td>Routine maintenance exercise such as oiling, greasing and cleaning of equipment and facilities is carried out by students under close supervision of lecturers.</td>
<td>2.77</td>
<td>0.87</td>
<td>Agreed</td>
</tr>
<tr>
<td>7</td>
<td>Change the crankcase oil and filter, if necessary every 100 hours of operation</td>
<td>2.73</td>
<td>0.32</td>
<td>Agreed</td>
</tr>
</tbody>
</table>

Pooled Mean(X): 3.02 Strongly Agreed

Table 3; shows that the pooled mean rating of technical staff in the items are above the mean benchmark of 2.50. These however indicates agreed. Therefore, the pooled mean of 3.02 shows that the technical staff have a positive agreement on the identified effective correction maintenance strategies for improving maintenance of laboratories equipment.

Table 4.4; Analysis of the responses on the problems affecting the effective maintenance of laboratory equipment N=245

<table>
<thead>
<tr>
<th>S/N</th>
<th>Item statement</th>
<th>Mean</th>
<th>SD</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Some lecturers do not possess the manipulative skills required to operate and do minor repairs</td>
<td>3.48</td>
<td>.57</td>
<td>Agreed</td>
</tr>
<tr>
<td>2</td>
<td>There is insufficient fund provide for the maintenance of laboratory equipment</td>
<td>3.55</td>
<td>.50</td>
<td>Agreed</td>
</tr>
<tr>
<td>3</td>
<td>The available laboratory equipment and facilities in use are not functioning</td>
<td>3.29</td>
<td>.75</td>
<td>Agreed</td>
</tr>
<tr>
<td>4</td>
<td>There is incessant power failure in the laboratory</td>
<td>3.15</td>
<td>.68</td>
<td>Agreed</td>
</tr>
<tr>
<td>5</td>
<td>Obsolete laboratory equipment and facilities were procured</td>
<td>2.94</td>
<td>.98</td>
<td>Agreed</td>
</tr>
<tr>
<td>6</td>
<td>Inferior quality of laboratory equipment and facilities are supplied</td>
<td>3.11</td>
<td>.90</td>
<td>Agreed</td>
</tr>
<tr>
<td>7</td>
<td>Orientation courses on maintenance practices are not organized for new laboratory attendant</td>
<td>2.77</td>
<td>.87</td>
<td>Agreed</td>
</tr>
</tbody>
</table>

Pooled Mean(X): 3.18 Strongly Agreed

Table 4; shows that the pooled mean rating of technical staff in the items are above the mean benchmark of 2.50. This however indicates agreed. Therefore, the pooled mean of 3.18 shows that the technical staff have a positive agreement on the identified problems affecting the effective maintenance of laboratory equipment.

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Table 4.4: Analysis of the responses on how the problems affecting the effective maintenance of laboratory equipment be remedied N=245

<table>
<thead>
<tr>
<th>S/N</th>
<th>Item statement</th>
<th>Mean</th>
<th>SD</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>There should be adequate supply of laboratory equipment and facilities</td>
<td>3.27</td>
<td>.03</td>
<td>Agreed</td>
</tr>
<tr>
<td>2</td>
<td>Minor faults should be repaired as possible to avoid total breakdown</td>
<td>3.32</td>
<td>.87</td>
<td>Agreed</td>
</tr>
<tr>
<td>3</td>
<td>Fund for maintenance of laboratory equipment and facilities should be under the control of superiors</td>
<td>2.57</td>
<td>.76</td>
<td>Agreed</td>
</tr>
<tr>
<td>4</td>
<td>Seminars, workshops and conferences on the importance of maintenance should be organized for staff and students</td>
<td>2.77</td>
<td>.87</td>
<td>Agreed</td>
</tr>
<tr>
<td>5</td>
<td>There should be prompt supervision of purchases and installation of new laboratory equipment and facilities</td>
<td>2.73</td>
<td>.32</td>
<td>Agreed</td>
</tr>
<tr>
<td>6</td>
<td>Rules and regulations to guide wears of the laboratory equipment and facilities should be established</td>
<td>3.32</td>
<td>.87</td>
<td>Agreed</td>
</tr>
<tr>
<td>7</td>
<td>Relevant training on equipment and facilities should be carried out on regular basis.</td>
<td>2.57</td>
<td>.76</td>
<td>Agreed</td>
</tr>
</tbody>
</table>

Pooled Mean(X): 2.94 Strongly Agreed

Table 4.5 shows that the pooled mean rating of technical staff in the items are above the mean benchmark of 2.50. These however indicates agreed. Therefore, the pooled mean of 2.94 shows that the technical staff have a positive agreement on the solutions to the problems affecting the effective maintenance of laboratory equipment.

H0: There is no significant difference in the mean ratings of MOUAU technical staff and ABSU technical staff on the effective preventive maintenance strategies for improving maintenance of laboratories equipment.

Table 4.6; t-test for the mean responses of MOUAU technical staff and ABSU technical staff on the effective preventive maintenance strategies for improving maintenance of laboratories equipment

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>X</th>
<th>SD</th>
<th>Df</th>
<th>t-cal</th>
<th>t-crit</th>
<th>Sig.</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOUAU</td>
<td>178</td>
<td>2.702</td>
<td>.675</td>
<td>159</td>
<td>1.35</td>
<td>1.67</td>
<td>.093</td>
<td>Accept Ho1</td>
</tr>
<tr>
<td>ABSU</td>
<td>67</td>
<td>2.689</td>
<td>.475</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: SPSS Independent T-test

Table 6; reveals that that t-calculated value of 1.35 is less than the t-critical at df = 159, where p > 0.05. This indicates that there is no significant difference between the mean ratings of MOUAU technical staff and ABSU technical staff on the effective preventive maintenance strategies for improving maintenance of laboratories equipment, thus the null hypothesis which states that “there is no significant difference in the mean responses of MOUAU technical staff and ABSU technical staff on the effective preventive maintenance strategies for improving maintenance of laboratories equipment was accepted.

4.2 Discussion of Findings

The result in Table 1shows that the pooled mean rating of technical staff in the items is above the mean benchmark of 2.50. These indicate that the staff agreed. Therefore, the pooled mean of 2.94 shows that the technical staff have a positive agreement on the identified effective preventive maintenance strategies for improving maintenance of laboratories equipment. This is in agreement with the view of Ezeji (2016) which stated that it would be a wise use of time for institutional maintenance workers to perform routine task such as cleaning, lubricating or adjusting tools. Most importantly, the students should be learning how to perform many of these tasks, since they will be part of their job responsibilities once they become employed on their own. Lubricating of equipment should be carried out on a daily basis. This will help to reduce friction, wear and corrosion of equipment.

Table 2 shows that the pooled mean rating of technical staff in the items is above the mean benchmark of 2.50. This however indicates agreed.
Therefore, the pooled mean of 3.02 shows that the technical staff have a positive agreement on the identified effective correction maintenance strategies for improving maintenance of laboratories equipment. The findings corroborate with the result reported by Uzoagulu (2011), who stated that the functionality of equipment and their availability can only ensure prompt maintenance.

The outcome in Table 3 shows that the pooled mean rating of technical staff in the items is above the mean benchmark of 2.50. This however indicates agreed. Therefore, the pooled mean of 3.18 shows that the technical staff have a positive agreement on the identified problems affecting the effective maintenance of laboratory equipment. This finding is in line with that of Olorunselu (2016), who stressed the need for electricity supply said that most of the equipment imported for laboratory can only be powered by electricity. The fear is that schools in rural areas without electricity supply will not benefit from such equipment. The problem of power supply is not peculiar with rural areas, but in all over. In recent times there is no adequately electricity supply to operate that equipment in the workshop.

The result in Table 4 shows that the pooled mean rating of technical staff in the items is above the mean benchmark of 2.50. This however indicates agreed. Therefore, the pooled mean of 2.94 shows that the technical staff has a positive agreement on the solutions to the problems affecting the effective maintenance of laboratory equipment. This is in agreement with the view of Lawal (2010), who stated that special attention must be given to regular training and upgrading of the skill of maintenance personnel, also on their own they should improve on their maintenance skills and techniques through training and retraining. Seminars, workshops and conferences on the importance of maintenance should be organized for the staff. With the changing of technology, it is imperative that all staff involved in workshop, laboratory keep up to date with latest practices.

**Conclusion**

The study concluded that there is need to adopt proper maintenance culture in laboratories of higher institution. So that the equipment will always be assessable and available for impartation of skills to the students.

There are several maintenance strategies that could be used by technical staff for improving maintenance of laboratories equipment in tertiary institutions. Thus, it is important to have preventive maintenance measure adopted and integrated into the laboratory and workshop programmes such that routine tasks like cleaning, servicing, and lubricating of equipment will be formed as a normal part of activity in the workshop. The laboratory personnel should ensure that periodic inspections are carried out on each equipment and a control system that will enable them to monitor maintenance activities in the laboratory, however, students should equally be instructed on the proper method to recognize faulty equipment by differentiating between proper functioning and faulty equipment. Relevant training on equipment and facilities maintenance and repairs should be encouraged and not neglected by the university authorities. This will enable the maintenance personnel to improve in knowledge and skills. Many problems were identified which constituted the main constrains hampering the effective maintenance activities in the laboratories. These constraints, if tackled will assist both students, technical staff and lecturers to embrace maintenance culture as an integral part of their lives. Items on possible remedies for the maintenance problems were also identified. If these measures are adopted and implemented it will improve the state of maintenance of laboratories equipment in tertiary institutions in Abia state.

**Recommendations**

The following recommendations were made:

1. All laboratory attendants should be sent for equipment maintenance training through seminars, workshops, conferences for effective preventive strategies.
2. Funds should be made available by the government, NGO, ETF to the universities management for effective corrective maintenance of the equipment and facilities.
3. Preventive maintenance should be constantly done on these equipment and facilities to prevent both damage and complete breakdown of these facilities and equipment.
4. Corrective maintenance should be carried out as soon as minor faults or breakdowns are detected so as not to create difficulties for students use.
5. All tertiary institutions in Abia state should be supplied with electricity for effective use of laboratory facilities and equipment supplied to their schools. Big electric generators should be made available where...
6. Sufficient number of competent laboratory attendants should be employed in order to implement maintenance culture in the schools as a way of remedying the problems.

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