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Preventive and Corrective Maintenance Practices on Instructional Technologies Adopted For Effective Instructional Delivery by Business Education Departments in Colleges of Education in Nigeria

Article History

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Abstract: The study was carried out to determine the preventive and corrective maintenance practices on instructional technologies adopted by Business Education Departments in Colleges of Education in Anambra and Enugu States of Nigeria. Two research questions and two null hypotheses guided the study. The population of the study was 165 lecturers and 10 laboratory attendants in Business Education Department. A 21-item-structured questionnaire was used for data collection. The questionnaire was validated and used to determine the reliability co-efficient of the instrument using Crombach Alpha approach, and 0.84 was obtained as the reliability coefficient. Mean and standard deviation were used to find answer to the research questions, while the hypotheses were tested using t-test statistic at the probability level of 0.05. The results of the analysis showed that the Business Education Departments adopted both the preventive and corrective maintenance practices. Based on the findings, it was recommended that the Departments should make deliberate efforts to strengthen the use of the preventive and the corrective maintenance practices. It was also recommended that qualified personnel should be employed to use and maintain the instructional technologies.

Keywords: Maintenance, Preventive Practices, Corrective Practices, Instructional Technologies.

1. Introduction

Instructional technologies play several roles in teaching and learning process, and as such they are regarded as veritable tool for behavioural change in the classroom. As a result of this, usage and maintenance of instructional technologies have become an integral part of every aspect of the educational system. This is most especially so when instructional technologies are deployed in higher institutions for teaching and learning. It is the responsibility of the school system to prepare students to use these instructional technologies; hence the need to adopt a good preventive and corrective maintenance practices on them. This will enable continuous and unbroken teaching and learning processes. To have a positive change in the learner, good teaching must take place; and to bring about good teaching, the teacher should be able to convey his/her messages in the simplest, most convincing and practical way to the learner through the application of instructional technologies.

Instructional technologies are those devices, tools and machines at the disposal of the teacher to enhance effective interaction with the students in the classroom setting. They include the hardware and software used in classroom for the purpose of teaching and learning that help to provide exciting learning experiences to the learner; which also help the teacher to have creative ways of making his work easier (Kurt, 2015). Instructional technologies are used to make teaching easier and practical for the teacher and the learners. For instance, using the projector to present lectures on the interactive whiteboard (IWB) makes students excited about the lecture and boosts their interest in learning. This can be used by the lecturers in practical demonstration classes such as in Word Processing, Microsoft Excel, PowerPoint presentation and other practical classes. Omorogbe and Imasuen (2017) noted that the use of electronically-mediated instruction to support the traditional face-to-face classroom instruction has resulted in the shift from teacher to student-centred-class. In this situation, the responsibility for learning is shifted to the student. The teacher facilitates learning by acting as a coach, resource guide and companion in learning.

Instructional technologies useful in teaching and learning Business Education programmes include interactive whiteboard (IWB), electronic whiteboard, electric and electronic typewriters, word-processing machine, overhead projector, televisions, Videocassette Recorders (VCRs), Digital Versatile Disc (DVD), Digital Versatile Disc Rewritable (DVD-RW), Flash Driver (FD), slide projectors, and opaque projectors as well as computers. Others are: digital camera, scanners, photocopying machines, printers, the internet, interactive television, audio/video conferencing; WebBoard, compact disk (CD) writer, liquid crystal display (LCD), modem, among others. Software tools include Microsoft Word (MSWord), Excel, PowerPoint, Publishers, telecommunications, among others. Artificial intelligence (AI) instrument are not left out. Artificial intelligence is a group of related technologies that attempt to emulate human-like qualities, such as learning, reasoning, communicating, seeing and hearing.

The importance of instructional technologies in teaching and learning cannot be over-emphasized. They help to make teaching and learning more meaningful, impactful and engaging. They are also imperative for learning, especially for students who are more visually oriented. They are equally useful in conducting examinations such as Computer-Based Tests (CBTs), among others. The objectives of using instructional technologies according to Wenatchee. (2015) are to meet the curricular needs of all learners; teach critical thinking skills and foster creativity. The increased application of advanced technologies and electronic devices in the classrooms has subsequently increased students' access to instructional technologies as well as the need for regular preventive and corrective maintenance practices to keep the instructional technologies in good working condition to ensure uninterrupted instructional delivery.

For instructional technologies to remain sustainable, they need proper maintenance. Maintenance practice is the process of keeping the equipment/machines in a reliable condition by regularly checking and repairing them when necessary. Wilson (2015) observed that no matter how sustainable a group of assets may have been in the original design and construction, they must be operated responsibly and maintained properly to continue to function as designed. To bring in any form of maintenance practices, the instructional technologies need to be assessed in order to determine the type of maintenance practices required.

Maintenance refers to the deliberate efforts made to ensure that equipment and machines are working reliably and effectively. Preventive maintenance is the regular and routine maintenance of machines and assets in order to keep them functioning and prevent costly unplanned downtime from unexpected failure (Sheut and Krajewski, 2014). The purpose is to prevent equipment and machine failure before it occurs and reduce the risk of accident. This requires keeping records of past inspections and servicing equipment and machines. Preventive services however, can pose some problems. Manney (2018) outlined the problems in operating preventive maintenance practices to include lack of data, setting interval, skipping machines, not understanding principles of preventive maintenance, among others.

On the other hand, corrective maintenance is a maintenance performed to ratify an identified or isolated fault so that the failed equipment and machines can be restored to an operational condition. Its main purpose is to restore the equipment and machines that have broken down. Martins (2018) described corrective maintenance practices as the technical activity carried out after a failure occurred and it is supposed to restore an asset to a condition in which it can perform its intended function maximally.

Appropriate preventive and corrective maintenance practices should be adopted so as to have quality and functional instructional technologies in Business Education Departments in higher institutions. The business educators have the responsibility of ensuring that machines and equipment they use are properly maintained. Where the maintenance involves some technical details, laboratory attendants/laboratory technician or laboratory technologists will carry out the maintenance.

It was reported by Audu and Umar (2013) that poor maintenance practices in Nigerian schools hinder effective teaching and learning, making the process rigorous and uninteresting to students and teachers. These machines and equipment are exposed daily to usage, breakdown and require maintenance. The failure and consequent breakdown of these machines may be as a result of poor skills possessed by the teachers and students operating them (Okoli, 2012); or due to poor maintenance practices on the instructional technologies as pointed out by Nwosu and Azih (2012). Wrong manipulation of the instructional devices requires maintenance action to prevent them from failing; and repair of damaged ones is important in order to keep them fit for regular operations. Unfortunately, inadequate number of laboratory technicians and/or laboratory attendants as reported by Iweh and Ufot (2012); and unavailability of technicians as stated by Azuka (2010), are some of the causes of delay in repairing these machines and equipment. Other negative attitudes in preventive and corrective maintenance practices are: delays in minor repairs or replacement of the worn-out parts of the machines, neglect to update computer software, antivirus in particular, and refilling tonner as in the case of word-processing machines, printers and photocopying machines.

Studies on machines and equipment maintenance have been carried out across the various educational sub-sectors in the country. Miller and Akume (2009) found unavailability of equipment, and indifference to the maintenance of available business studies equipment on the part of government and the school authorities. In another study, Bolarinwa and Ojetunde (2009) also found that available resources such as materials, equipment and facilities and other needed tools to run the Business Education programmes were scarcely maintained. Also, Sheut and Krajewski (2014) in their study on decision model for corrective maintenance found out that corrective maintenance practices is ignored in most organisations. These studies were, however, silent on instructional technologies maintenance in colleges of education. College of education are regulated by the National Commission for Colleges of Education (NCCE), and are charged with the responsibility of training prospective teachers for Nigeria's Basic Education programme. The colleges owned by government (federal and state) are here referred to as public institutions and those owned by individuals or organizations are here referred to as Private colleges of education. Business Education or Business Teacher Education is a teacher education programme for producing teachers for the Junior Secondary Business Studies in Nigeria.

2. Statement of the Problem

The use of instructional technologies is very important in teaching and learning in Business Education Programmes. They make teaching and learning interactive, and motivates the learner as well. Instructional technologies change the way teachers teach, offer educators effective ways to reach different types of learners; and assess students' understanding through multiple means. However, these instructional technologies which are daily exposed to educational process, are given a low maintenance priority and left with poor maintenance practices, and sometimes abandoned for a long time with inefficient care. Rufai and Idris. (2013) observed that negligence in the maintenance of school facilities has many negative consequences. When machines and equipment in schools are inadequately maintained, they constitute health hazards to students and teachers who use them. All of these have implications for the conduct of educational activities in various institutions of higher learning, and Colleges of Education in particular. The preventive and corrective maintenance practices on instructional technologies adopted by Business Education Departments in Colleges of Education were what the study was poised to assess.

3. Purpose of the Study

The major purpose of the study is to determine the preventive and corrective maintenance practices adopted by Business Education Departments in colleges of education. Specifically, the study sought to determine:

The preventive maintenance practices on instructional technologies in Business Education Departments in the colleges of education.

The corrective maintenance practices on instructional technologies in Business Education Departments in colleges of education.

4. Research Questions

The following two research questions guided the study:

1. What are the preventive maintenance practices on instructional technologies adopted by Business Education Department in Colleges of Education?

2. What are the corrective maintenance practices on instructional technologies adopted by Business Education Department in Colleges of Education?

5. Hypotheses

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

1. There is no significant difference in the mean ratings of respondents (Lecturers Laboratory Attendants) on the preventative maintenance practices on instructional technologies adopted by Business Education Departments.
2. There is no significant difference in the mean ratings of the respondents from public and privately owned colleges of education on the corrective maintenance practices on instructional technologies adopted by Business Education Departments.

6. Methodology

The study adopted a survey research design. The study was carried out using Colleges of Education in Enugu and Anambra States of Nigeria that offer Business Teacher Education programme. The population of the study consisted of one hundred and sixty five (165) lecturers and ten (10) laboratory attendants, giving a total population of one hundred seventy five (175). There was no sampling because the population is sizeable enough. Instrument for data collection was a-21-item structured questionnaire. The questionnaire consists of two parts A and B. Part A was used to collect information on personal data of the respondents; while Part B was used to collect data for the study. The instrument was duly validated by experts in Business Education and Measurement and Evaluation, all from Ebonyi State University, Abakaliki. In other to determine the reliability of the instrument, copies of the instrument were distributed to lecturers and laboratory attendants of the Federal College of Education (Technical), Bichi in Kano State. The entire items had reliability co-efficient of 0.83 obtained by using Cronbach Alpha approach while clusters one and two yielded reliability co-efficient of 0.82 and 0.83 respectively. The instrument was personally administered with the help of research assistants (one from each college), and retrieved a week after with the help of research assistants for onward collection by the researcher at an agreed time and location.

The data generated were analyzed using mean and standard deviation for answering research questions and determining the homogeneity of the respondents' view. T-test statistic was used to test the hypotheses at 0.05 level of significance. Interpretation of the results was based on the real limit of numbers: 0.05 – 1.49 (Strongly Disagree (SD); 1.50 – 2.49 (Disagree (D); 2.50 - 3.49 (Agree (A); and 3.50 – 4.00 (Strongly Agree (SA) respectively. A null hypothesis was accepted when the calculated t-value was lower than the table t-value. Otherwise, the null hypothesis is accepted.

7. Results

Research Question 1:

What are the preventive maintenance practices on instructional technologies adopted by Business Education Departments in colleges of education?

Data collected to answer the research question is presented in Table 1.

Table 1. Respondents' mean ratings on the preventive maintenance practices (PMP) adopted by Business Education Departments on Instructional Technologies (N=175)

S/N	Preventive maintenance practices types	Mean	Std	Interpretation
1	Clean the instructional technologies before use.	3.17	1.23	A
2	Cover machines whenever not in use to prevent Dust.	3.68	0.70	SA
3	Lubricating the machines periodically.	3.28	0.98	A
4	Organise computers in proper order to avoid falling from the tables	3.32	1.02	A
5	Students are encouraged to clean the machines Before manipulating them.	3.35	0.98	A
6	Update computer software such as antivirus When need be.	3.57	0.95	SA
7	Refill tonner in the printers regularly to avoid Disrupting lectures.	3.71	0.68	SA
8	Refill the tonner in photocopying machines before it dries up	3.84	0.47	SA
9	Carefully remove jammed papers in Photocopying	2.51	1.11	A
10	Carefully remove jammed papers on the printers.	3.36	1.01	A
11	Restriction of unauthorized persons into the laboratory in the absence of laboratory attendant	3.25	1.07	A
	Grand Mean	**3.06**		

Source: Data Collected using Questionnaire.

Table 1 shows the Mean and Standard Deviation values rated for the items on preventive maintenance practices. The respondents agreed on all the items as preventive maintenance practices

adopted on instructional technologies in Business Education Departments in colleges of education. The standard deviations ranged from 0.47 to 1.23. The spread of the standard deviation is an indication that the respondents varied in their opinions about preventive maintenance practices on the instructional technologies. However, with the grand mean of 3.06 implies that Business Education Departments apply the preventive maintenance practices.

Research Question 2:

What are the corrective maintenance practices on instructional technologies adopted by Business Education Departments in colleges of education?

Data collected to answer the research question is presented in Table 2.

Table 2. The mean ratings of respondents on the corrective maintenance practices (CMP) adopted by Business Education Departments on instructional technologies (N=175)

S/N	Corrective maintenance practices types	Mean	Std	Interpretation
1	Repair the damaged machines when they fail.	3.27	1.04	A
2	Renew antivirus programme when the computers Are locked.	3.13	1.20	A
3	Service instructional technologies for accreditation purposes as against when due	2.76	1.01	A
4	Update computer software when they expire.	1.66	0.99	D
5	Repair damaged computers for examinations.	3.48	0.97	A
6	Repair the printers when they fail to work.	3.38	0.96	A
7	Repair scanners when they are stop working.	2.84	1.40	A
8	Service photocopying machines because they Stopped functioning.	2.98	1.27	A
9	Instructional technologies are not replaced when they show sign of weakness	2.65	1.06	A
10	Service projectors because they no-longer Function.	3.06	1.26	A
		2.92		

Source: Data collected using questionnaire.

Table 2 shows the Mean and Standard Deviation values of the items on corrective maintenance practices. The respondents agreed with nine of the items and disagreed with item number 4 (meaning that updating computer software when they expire is not a corrective maintenance practice). With grand mean of 2.92, Business Education Departments use the corrective maintenance practices on the instructional technologies.

Hypothesis 1: There is no significant difference in the mean ratings of lecturers and laboratory attendants on the preventive maintenance practices on instructional technologies adopted by Business Education Departments.

Data collected to test the hypothesis is presented in Table 3.

Table 3. t-test analysis of lecturers and laboratory attendants mean ratings on the preventive maintenance practices (PMP) on the instructional technologies

Group	N	Mean	SD	Df	t-cal	t-crit	Level of Sign.	Difference
Lecturer	165	3.40	0.91					
Lab. Attendant	10	2.85	0.70	173	2.47	1.96	0.05	

Source: Data collected using questionnaire.

The result on Table 3 shows t-test analysis of the mean ratings by respondents (Lecturers and Laboratory attendants) on the preventive maintenance practices on instructional technologies. The t-calculated value of 2.47 is greater than the critical t-value of 1.96 at 0.05 level of significance and 173 degrees of freedom. The null hypothesis is therefore rejected. This means that there is a significant difference in the mean responses of lecturers and laboratory attendants.

Hypothesis 2: There is no significant difference in the mean ratings of the respondents from public and private owned colleges of education on the corrective maintenance practices on instructional technologies adopted by Business Education Departments.

Data collected to test the hypothesis is presented in Table 4.

Table 4. t-test analysis on the mean ratings of respondents on corrective maintenance practices on instructional technologies

Group	N	Mean	SD	Df	t-cal	t-crit	Level of Sign.	Difference
Public	124	3.17	0.95					
Private	51	2.20	0.82	173	3.67	1.96	0.05	Significant

Source: Data collected using questionnaire.

The result on Table 4 shows the mean ratings of the respondents from public colleges of education and those from privately owned colleges of education in Anambra and Enugu States on the corrective maintenance practices. The calculated t-value of 3.67 is greater than the critical t-value of 1.96 at 0.05 level of significance, and 173 degrees of freedom. The null hypothesis is therefore rejected. This implies that there is a significant difference in the mean ratings on corrective maintenance practices based on ownership of the institutions.

8. Discussion

The result of the data analysis revealed that Business Education Departments apply preventive maintenance practices on instructional technologies. Preventive maintenance is maintenance services on the instructional technologies to prevent them from breaking down when in use. It is proactive and adds value to the instructional technologies. This is consistent with the recommendation of Adolfsson and Tuvstarr (2011) and Uzoigwe (2010) that there should be constant and routine maintenance practices on instructional technologies to save cost of buying new ones. The data analysis also indicated a significant difference between the mean responses of lecturers and laboratory attendants on the preventive maintenance practices. This means that career positions of the respondents influenced their responses. This may be as a result of the great difference in the number of lecturers (165) as against the number of laboratory attendants (10).

On corrective maintenance practices, the result of the study indicated that Business Education Departments also consistently apply corrective maintenance practices. Repairing of damaged machines, replacing of worn-out parts of machines or purchasing of new machine parts are carried out on special occasions such as examinations, accreditation, et cetera, or when the machines are bad and could no longer function effectively. This is not in agreement with the findings of Sheut and Krajewski (2014) that corrective maintenance practice is ignored in most organisations.

The study also revealed that the respondents agree with all the suggested corrective maintenance practices as the ones adopted in their institutions. The study also revealed that there is a significant difference in the mean responses of the respondents from public colleges of education and those from private owned colleges of education on corrective maintenance practices used in the colleges of education studied. This indicates that ownership type (public or private) influenced mean ratings of the respondents. This may also be as a result of the fact that private individuals or organisations are better managers of enterprises than governments, particularly in some African countries including Nigeria. Governments may provide more instructional technologies in quality and quantity, but the private sector owners would certainly be more effective and efficient in providing both preventive and corrective maintenance services for the instructional technologies to keep them consistently functional.

9. Conclusion

Based on the findings of the study, It was concluded that the colleges of education studied use the prevent and corrective maintenance practices on their instructional technologies; and that the career positions of the respondents (lecturers and laboratory attendants) and the institutional ownership types (public and private) are influencing factors or determinant factors on the maintenance practices used in the Business Education Departments in the various colleges of education.

10. Recommendations

Based on the findings of the study and the conclusions drawn, it was recommended that:

1. Departments of Business Education in colleges of education should continue to use and further strengthen the preventive and corrective maintenance practices on the available instructional technologies.

2. Departments of Business Education in colleges of education should ensure that qualified and experienced lecturers and laboratory attendants or technicians are employed who would be able to manage and apply appropriate preventive and corrective maintenance practices on their instructional technologies. This would minimize frequent break down of instructional technologies.

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