ADEQUACY AND UTILIZATION OF EDUCATIONAL RESOURCES IN TEACHING AND LEARNING OF ELECTRICAL AND ELECTRONICS ENGINEERING PROGRAMMES: A CASE STUDY OF UNIVERSITIES IN NORTHERN NIGERIA

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Abstract

The study was designed to investigate the adequacy and utilization of educational resources in teaching and learning of electrical and electronics engineering programmes: a case study of universities in northern Nigeria. Three research questions and one hypothesis guided the study and tested at P< 0.05. A survey design was employed for the study. The target population for this study was made up of 187 lecturers, 61 technical staff and 812 final year students in the universities in northern Nigeria offering electrical and electronics engineering as a programmme and has graduated students in the last five years The purposeful random sampling was used to sample two universities from each of the three geo- political zones in northern Nigeria, making a total of six universities, random sampling was used to sample 91 Lecturers, 47 Technical staff, and 371 500Level students. In carrying out the study a 42-items questionnaire validated by three experts was used to collect data. Ratio, mean statistics, standard deviation and Analysis of Variance (ANOVA) were used in the analysis. The findings revealed that the ratio of Professors to Senior Lecturers to Lecturers is 10:14:76; the ratio of lecturers to students is 1:36; Instructional materials like models, pictures, computer facilities are inadequate. It is recommended among others that; institutions should make effort to employ qualified staff to ensure that 20:35:45 of Professors to Senior Lecturers to Lecturers and 1:15 of Students to Lecturers and Instructional materials such as televisions, projects, filmstrips, models, computer facilities and pictures should be made available, because adequate use of it offer a variety of reality of experience which stimulates self-activity on the part of learner and also it hold the learner's attention.

Introduction

Engineering education is considered by most countries as essential for development as it is linked to economic and nation's success. Engineering uses forces and laws of nature to convert raw materials into goods and services. Engineering programmes are the main source of skilled labour for the industries. Thus, the level and relevance of the skills acquired in the educational institutions are directly related to the evolution of the industrial sector of the economy. Gupta (2006) opined that electrical energy occupies the top grade in energy hierarchy, and the impact of electrical energy can be seen or felt in industries, communication, transportation, agriculture and other section of the economy. Electricity therefore, forms the basis for industrial and production growth of a nation. King (1995) affirmed that for any industry to remain in production, it would require the services of competent Electrical Engineers to install machines that are electrically operated and to maintain such machines and equipment. Nigeria will continue to be in blackout if well- trained Electrical Engineers are not readily available to man our electrical industries. King further maintained that electrical engineering programme is one of the sources through which industry can get its steady supply of trained manpower. There will be no industry if there are no personnel to man it. This signifies that the service of Electrical Engineers is greatly needed and competent electrical and electronics engineers can only emerged from institutions that are well equipped and have facilities for their instruction.

Adeogun (1999) stated that educational resources refer to the available facilities that can be used to achieve educational goals and objectives. These include Physical, human, materials resources. He further classified these educational resources as:

(i) Physical resources: Classrooms, laboratories, libraries, hostel, technical equipment, machines, projectors, oscilloscope and computers.
(ii) Human resources: Lecturers, technical staff, administrative staff and students.
(iii) Material resources: text books, maps, models, pictures, soft ware and electricity.

Educational resources enhance the meaning of what is presented to learners provided that the learning resources are not presented haphazardly. He also emphasized that the availability, relevance and adequacy of educational resources contribute to academic achievement and non-availability of these equipment and materials contribute to the poor quality assurance and poor academic performance. Quality and quantity teaching staff is very important in the teaching and learning. Gyallesu (1992) opined that success of any educational system no matter how well it is planned depends to a large extends on the quality and quantity of teachers. The personnel involved in implementation of electrical and electronics engineering programme in Nigerian universities includes lecturers, technical staff and administrative staff, but this study will lay emphasis on lecturers and technical staff as personnel, because they are directly involved in the training of students. Isa (1997) stated that, most of the technology programmes in Nigerian schools at all levels are faced with problems of inadequate number of well qualified teachers. FRN (2004) acknowledges that, no education system can be better than the teachers who operate it. Isa (1997) stressed further that, teachers who are occupationally qualified and competent in their subject area contribute immensely to the success of any educational programme. NUC (2007) adopted a new staff profile, that academic staff ratio of Professors to Senior Lecturers to lecturers is now set at 20: 35: 45 and the new teacher, student ratios have been set to 1:15.

Olaitan, Igbo, Onyemachi and Ekong (1999) enumerated some of the strength associated with the economic utilization of instructional materials as follows:

(i) The learner will be provided with the knowledge and skills of manipulation and management of equipment, tools and materials.
(ii) The learners will be exposed to opportunities that will help them develop skills of self instruction.
(iii) It will help mastery of knowledge of manipulation processes which can enhance retention, recall and improvement of what is learnt through substitution of materials devices.
(iv) It enables the learner to diversify knowledge and skills in the utilization of instructional materials. That is, the learner can use materials for other purposes.

Gambari and Gana (2005) observed that, there are lots of problems facing the effective teaching of pure science, applied science and engineering related disciplines at all levels of educational institutions. One of the problems they highlighted was ineffective communication channels through which pieces of information, ideas, and concepts could be disseminated to the learners. Effective communication through instructional media is paramount to effective teaching and learning. They also maintained that in education instructional materials are some of the most important devices, which both teachers and students can use to enhance the quality of an instruction. This is because the materials are seen by educators as facilitators of teaching and learning activities when properly used. The list of instructional materials that teacher can use to improve the quality of instruction is in exhaustive. The teacher's level of resourcefulness, creativity and imagination is the limit. Instructional materials include curriculum materials, educational materials and audio-visual materials that are used by the teacher to make their lessons more meaningful and understandable, such materials include textbooks, supplementary books, posters, programmed texts, and print materials

like film, filmstrips, models, mockups, slides, audio and video tapes, records, chalkboard, projection equipment and educational television.

The leading qualities of a good engineer are ability, imagination and solid judgment. Technical ability depends on technical knowledge (Akintunde, 1994). Engineering programme must impact technical skill as well as financial, communication and social political skills. Early exposures of students to technical programmes as well as developing their computer knowledge base will develop their creative thinking and technical skills and help them understand easily what they are taught. However evidences show that there is high incidence of Engineering programmes graduates unemployment of which Electrical and Electronics Engineering inclusive (Atsumbe, 2006). The prevalence of electrical and electronics engineering graduates, unemployment and even the fact that employed ones are not performing, makes one query the adequacy and effective utilizations of electrical and electronics equipment for skill acquisition. It is then necessary to assess the adequacy and utilization of electrical and electronics equipment in universities in Northern Nigeria.

Purpose of the Study

The main purpose of this study was to assess adequacy and utilization of educational resources in teaching and learning of Electrical and Electronics Engineering Programmes in the Universities in Northern Nigeria. Specifically, the study assesses;

(i) The extent which teaching staff meets the provision of the minimum academic standard in Electrical and Electronics Engineering Programmes in the Universities in Northern Nigeria.
(ii) The adequacy of facilities for implementing Electrical and Electronics Engineering Programmes in the Universities in Northern Nigeria.
(iii) The extent of utilisation of facilities in Electrical and Electronics Engineering programmes in the Universities in Northern Nigeria.

Research Questions

This study provided answers to the following research questions

(i) To what extent does the teaching staff meet the provision of the minimum academic standard in Electrical and Electronics Engineering Programmes in the Universities in Northern Nigeria?
(ii) How adequate are the facilities in Electrical and Electronics Engineering Programmes in the Universities in Northern Nigeria?
(iii) To what extent are facilities in Electrical and Electronics Engineering programmes used in the Universities in Northern Nigeria?

Hypothesis

The following null hypothesis was formulated to guide the study and was tested at .05 level of significance.

Ho_1: There is no significant difference between the mean responses of lecturers, Technical Staff and students with respect to adequacy of facilities in Electrical and Electronics Engineering Programmes in the Universities in Northern Nigeria.

Materials and Methods

A survey research design was adopted for this study. The study covered all the universities in Northern Nigeria (North East, North West and North Central geo-political zones) where electrical and electronics engineering is being offered as a programmme and has graduated students in the last five years. The target population for this study was made up of 187 lecturers, 61 technical staff and 812 final year students of all the Universities in Northern Nigeria where Electrical and Electronics Engineering is being offered as a programmme and has graduated students in the last five years. The total population is 1060. Purposeful sampling was used to sample two universities from each of

the three geo- political zones in Northern Nigeria, making a total of six universities and random sampling technique was also used to select 91 lecturers, 47 technical staff and 371 students, making the total of 509 sampled. The data collected was analyzed using mean and analysis of variance (ANOVA). To establish the validity of the instrument for the study, the research instrument was subjected to both face and content validation by the experts in Industrial and Technology Education Department and Electrical and Electronics Engineering Department all in Federal University of Technology Minna.

To determine the acceptance level the resulting mean was added (1+2+3+4) and divided by 4 to get 2.50 which was used as cut off point or deciding point between agreed and disagreed. This mean that items with mean values of 2.50 and above were considered as agreed while items with values of 2.49 and below were considered as disagreed. For testing hypothesis, f-critical value of 2.42 was chosen. Any value equal or less was considered not significant and above was considered significant.

Results

Table 1: Ratio of professors to senior lecturers to lecturers in electrical and electronics engineering in the universities in northern Nigeria

Rank	Number	Ratio
Professors/Associate Professors	12	10
Senior Lecturers	17	14
Lecturers*	90	76
Total	119	100

* Lecturer I to Assistant Lecturer

Shows the ratio of Professors to Senior Lecturers to Lecturers are 10:14:76, this finding is not in agreement with NUC minimum academic standard of the ratio of Professors to Senior Lecturers to Lecturers as 20:35:45.

Table 2: Ratio of lecturers to students

Status	Number	Ratio
Lecturers	119	1
Students	4,322	36

The analysis revealed the ratio of lecturers to students as 1:36, meaning that it is no inline with NUC minimum academic standard of 1:15

Research Question 2

How adequate are the facilities in Electrical and Electronics Engineering programmes in the Universities in Northern Nigeria?

Table 3: Respondents mean scores on the adequacy of facilities in the electrical and electronics programmes in the universities in northern Nigeria.

		$N_1 = 91$		$N_2 = 47$ $N_3 = 371$		
S/No	ITEM	$\overline{X_1}$	$\overline{X_2}$	$\overline{X_3}$	$\overline{X_t}$	Remarks
1	Workshop space for students.	3.42	3.20	3.12	3.25	Adequate
2	Electricity from National grid	2.02	2.34	2.28	2.21	Not Adequate

3	Standby generator.	2.34	2.36	2.41	2.37	Not Adequate
4	Library facilities	2.46	2.32	2.08	2.29	Not Adequate
5	Televisions,	2.36	2.46	2.30	2.38	Not Adequate
6	Video Tape	2.11	2.26	2.50	2.29	Not Adequate
7	Soft wares	2.32	2.48	2.14	2.31	Not Adequate
8	Projectors.	2.06	2.40	2.24	2.24	Not Adequate
9	Pictures,	2.56	2.71	2.42	2.56	Adequate
10	Filmstrips	1.96	2.05	2.32	2.11	Not Adequate
11	Computer facilities.	2.02	2.14	2.27	2.14	Not Adequate
12	Internet facilities	2.20	2.00	2.16	2.12	Not Adequate
13	Transducer of instrumentation trainer	2.46	2.05	2.34	2.28	Not Adequate
14	Digital systems trainers.	1.98	2.04	1.87	1.96	Not Adequate
15	Oscilloscope	2.01	2.32	2.14	2.16	Not Adequate
16	Electrical machines control panel	3.02	2.68	2.56	2.75	Not Adequate
17	High power motor generating set	2.09	2.41	1.94	2.15	Not Adequate

N_1, N_2 and N_3 = Number of Lecturers, Technical staff and students respectively

$\overline{X_1}$ =Mean responses of lecturers; $\overline{X_2}$ = Mean responses of technical staff

$\overline{X_3}$ = Mean responses of student $\overline{X_t}$ = Average mean responses of all respondents

Analysis of mean responses of the three groups of respondents reveals that 16 out of the 19 items under this sub-heading are adjudged as not adequate with a grand mean ratings ranging from 2.53 – 3.25. Together, the three groups considered 1, 9 & 18 items adequate.

Research Question 3

To what extent are these facilities put into use in Electrical and Electronics Engineering programmes in the Universities in Northern Nigeria?

Table 4: Respondents mean scores on extent which facilities put into use in electrical and electronics engineering programmes in the universities in northern Nigeria

		N_1 = 91		N_2 = 47	N3 = 371	
S/No	ITEM	$\overline{X_1}$	$\overline{X_2}$	$\overline{X_3}$	$\overline{X_t}$	Remarks
1	Library facilities	2.34	2.46	2.14	2.31	Low Extent
2	Computer facilities	2.10	2.31	2.26	2.22	Low Extent
3	Televisions,	1.23	1.68	2.01	1.64	Low Extent
4	Stimulators	1.20	1.34	1.62	1.39	Low Extent
5	Video Tape	1.32	1.82	1.56	1.57	Low Extent
6	Projectors.	2.26	2.44	2.32	2.34	Low Extent
7	Internet facilities	2.46	2.34	2.31	2.37	Low Extent
8	Pictures	2.04	1.98	2.21	2.07	Low Extent
9	Filmstrip	1.96	1.84	2.20	2.00	Low Extent
10	Signal generator	2.11	2.32	2.42	2.28	Low Extent
11	Transducer of instrumentation trainer	2.08	2.14	2.34	2.19	Low Extent
12	Digital to analogue converter	2.52	2.12	2.08	2.24	Low Extent
13	Memory demonstration module	2.48	2.14	2.32	2.31	Low Extent
14	Electrical machines control panel	2.08	2.11	2.06	2.09	Low Extent
15	High voltage generating set	2.32	1.90	2.34	2.19	Low Extent
16	Electronic wattmeter	2.11	2.18	2.26	2.18	Low Extent
17	Models	2.10	2.32	2.41	2.28	Low Extent

18	Oscilloscopes.	2.56	2.42	2.32	2.43	Low Extent
19	High power motor generating set	2.34	2.08	2.11	2.18	Low Extent

Table 4 revealed that all the three groups of respondent agreed that most of the facilities are put into use to low extent, with the average mean of less than 2.50.

Table 5: One-way analysis of variance of the mean responses of respondents on the adequacy of facilities in electrical and electronics engineering programmes in the universities in northern Nigeria

Source of Variation	Sum of Squares	df	Mean Squares	f-cal	f-critical	Decision
Between groups	0.01268	2	0.00634			
Within groups	349.83	507	0.69	0.0092	3.42	NS*
Total	348.50	509				

* Not Significant

The result of analysis as presented shows that there was no significant different (P> .05) in the mean responses of lecturers, technical staff and students on the facilities in Electrical and Electronics Engineering programmes in the Universities in Northern Nigeria. Thus, the null hypothesis was not rejected as f-cal of 0.0092 was less than f-critical of 3.42 set for accepting and rejecting hypothesis.

Discussion of Findings

The findings revealed that the mix of professors/associate professors to senior lecturers to other lecturers are 10:14:76 respectively and the mix of lecturers to students is 1:36. These findings are not coming as a surprise because Kofoworola (2003) and Bamisaye (2005) averred that, there are serious problems affecting the quality of engineering programmes in Nigeria, such as the low number of lecturers with PhD qualifications. And it is unhealthy situation where most of the academics belong to the junior cadre (lecturer II and assistant lecturers who are still learning), by virtue of their qualifications (having only masters degree and minority the senior cadre). However, it is clear that if this situation persists, the standard and the quality of the programme will drop. Bamisaye (2005) added that staffing situation in Nigerian universities is pathetic and is even worst for engineering departments having as high as 1:60; this resulted due to up-surge in the number of students admitted to the engineering programmes without increase in staff. The findings are not in consonance with the new staff profile adopted by NUC (2007) that academic staff ratio of professors to senior lecturers to lecturers should be 20:35:45 and the new teacher, student ratio has been set to 1:15.

The findings revealed that the Electrical and Electronics Engineering programmes in the institutions under study have adequate workshop but the equipment and machineries are not adequate. This finding confirms the findings of Daniel (2002) that engineering programmes in Nigerian higher institutions have workshops and laboratories but they are ill-quipped with equipment and machineries. They stressed further that most of the equipment were not properly maintained and damaged equipment were not replaced. Bamisaye (2005) lamented that inadequate laboratory/workshop equipment are direct consequence of under-funding of our faculties of engineering and he said only few of such faculties can boast of adequate training facilities in form of laboratory and workshop equipment. In places where equipment are available, they are either obsolete or non-functioning and this has greatly affected teaching and research activities that ought to be the hallmark of such faculties.

Olaitan et al (1999) stated that the requisite curriculum support facilities in a university include: the infrastructure, equipment supplied, library facilities, communication, recreational facilities and environment. They further said the quality of education at this level depends on the existence and good condition of these. But in many higher institutions most of them are too obsolete, poor, non-functional, inadequate in type, or not in existence. The availability of facilities is known to be one of the most important factors that govern learning. When these facilities are not adequately provided learning becomes ineffective. Isa (1997) confirmed that, a well-equipped workshop with recommended facilities for teaching is of utmost importance for good delivery and quality of the course.

The study revealed that library facilities, computer and internet facilities are inadequate. This is in line with the work of Edem, Ani and Ocheibi (2009) which affirmed that library is meant to support the university in area of learning, teaching and research; the library is regarded as the "heart" of any academic institution particularly the university. But to the surprise many universities have ill-equipped with up-to-date books and modern information sources in electronic formats, such as e-books, e-journals and internets. Kamba (2009) reported that despite the potentials of Information and Communication Technology (ICT) to enhance the activities of teaching, learning and research, report showed that the application of ICT in Nigerian tertiary institutions is less than 5%. He further said that apart from e-learning, other ICT infrastructures are also aiding effective teaching and learning in the traditional classroom set-up. Availability of personal computers and its accessories have enhanced the output of teachers and students. Tertiary institutions in Nigeria lack adequate ICT infrastructures to effectively tap into the opportunities offered by the cyber space. Personal computer where available in most Nigerian tertiary institutions are not easily accessible to students because of poor numbers of personal computer to students ratio which is averagely put at about 1: 40. Adedoyin, Akinuwesi and Adegoke (2008) said that internet connectivity is available in most tertiary institutions in Nigeria, but in most cases the bandwidth subscribed to which determines speed of access is too small to support any meaningful academic activities during the peak period.

The findings show that equipment such as frequency tester, signal generator, transducer of instrumentation trainer, analogue oscilloscope and instructional media like computer, television, audio tapes, projectors and library facilities are not often used. This may not be a surprise because the respondents agreed that the facilities are not adequate and coupled with irregular supply of electrical power to workshop/laboratories. Orikpe (1995) noted that many of this equipment are not only uninstalled but are under-utilized and uncared for. Such an attitude negates the basic purpose of purchasing them. They further noted that schools are often poorly equipped and where little existed they were not properly put into use. Gambari and Gana (2005) asserted that there are lots of problems facing the effective teaching of pure science, applied science and engineering related disciplines at all levels of educational institutions. One of the problems they highlighted was inability of the teacher to utilize facilities around him to effectively communicate ideas, concepts and skills to the learners. Electrical and Electronics as a discipline which lays much emphasis on skills cannot function well without adequate provision and use of facilities like books, equipment, tools, materials, workshops and laboratories.

Hypothesis compared the mean responses of lecturers, technical staff and students on the adequacy of facilities in electrical and electronic engineering programme. The results revealed that there is no significant difference in their mean responses. This mutual agreement is not coming as a surprise because lecturers, technical staff and students are aware of the shortage of facilities in workshop/laboratories and that have been a hindrance to skill acquisition in Nigerian universities. Bamisaye (2005) pointed out that engineering schools in Nigeria are beset by poor library facilities and inadequate facilities and these have affected practical activities in our workshops/laboratories.

Conclusion

The production of well- trained Electrical and Electronic Engineering graduates to work in private and public sector of economy is the desire of the government, parents, students and academics. This study found out that the Lecturers to student's ratio do not meet up with NUC requirement. It was also found out that facilities in Electrical and Electronic Engineering programme is not adequate, and the available facilities are not often put into use. If the Electrical and Electronic Engineering graduates in Northern Nigerian universities will be adequately equipped to meet up with the challenges of the ever dynamic technology labour market and to meet up with the changes in Electrical and Electronic industries, there is need for proper implementation of Electrical and Electronic Engineering programmes in Northern Nigeria Universities.

Recommendations

Based on the findings of this study and their implications, the following recommendations are made:-

(i) The institutions should make effort to employ qualified staff to ensure that 20:35:45 of Professors to Senior Lecturers to Lecturers and 1:15 of Students to Lecturers recommended by NUC is achieved and the resources should be made available to train and retrain the staff.

(ii) Workshops and laboratories should be well equipped with up-to-date equipment, tools and machineries to facilitate teaching, learning and research work. And this can be achieved by proper funding of the programme by federal government; institutions should also seek for assistant from Electrical and Electronic industries and individuals.

(iii) Instructional media such as televisions, projectors, filmstrips, models and pictures should be made available, because adequate use of it offer a variety of reality of experience which stimulates self-activity on the part of learner and also it hold the learner's attention. Instructional aids can be made available through proper funding and the lecturers should learn to improvise when the need arises.

(iv) Department should ensure that every course with practical components are properly implemented such that will give the students opportunity to often use the facilities in the workshops/laboratories. Practical lessons should be included in departmental timetable and it should be followed adequately.

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