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Strategies for Improving the Teaching and Learning of Electrical and Electronics Subjects in Technical Colleges

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Abstract

This study investigated the strategies for improving the teaching and learning of electrical and electronic subjects in Ebonyi State technical colleges. Two research questions and two hypotheses guided the study. The research design adopted for the study was survey. A sample of 240 was randomly drawn from a total population of 775 teachers and students of electrical and electronics in Ebonyi State technical colleges. A four-point response scale validated structured question was the instrument used for data collection with a reliability coefficient of 0.92 internal consistency. Mean and standard deviation were used to answer the research questions while student t-test statistic was used to test the hypotheses at 0.05 level of significance. Twenty and eleven potent strategies respectively were found for improving teaching and learning of electrical and electronics subjects in Ebonyi State technical colleges. It was then recommended that all these potent strategies should be implemented immediately in other to improve the teaching and learning of electrical and electronics subjects in Ebonyi State technical colleges in Nigeria.

Keywords: Strategies, improving, teaching, electrical and electronics, colleges

1. Introduction

Electrical and electronic subjects are offered in Ebonyi State technical colleges to train students in both theories and practices of electrical and electronics technology at sub-professional level as craftsmen and technicians. According to FGN (2004) electrical and electronics trade subjects principally include (1) electrical installation and maintenance work (2) Radio, television and electronics work. Some diverse practical contents deal with appliances repairs both in domestic and industrial premises where electrical and electronics systems operate. NBTE (2001) and NABTEB (2004) gave details of electrical and electronics engineering trade subjects taught in Nigerian technical colleges as follows: (1) Domestic and industrial installation (2) cable jointing and repairs (3) battery charging and repairs (4) winding of electrical machines (5) Basic electricity (6) electrical electronic drawing and calculations (7) radio communications and services (8) television services and repairs (9) electronic devices and circuits. In most technical colleges, these subjects are grouped into two to reflect the faculties of electrical engineering and electronics engineering from where the trades emanated.

Each group is taught and administered as a separate department in most Nigerian technical colleges. The first department handle field of physical science and technology concerned with the phenomena of electric charge, current, power and energy, and thereby called electrical department. The second department handles study of the properties and behaviour of electrons under all conditions especially with reference to technical and industrial application; and thereby called electronics department (R/TV). Electronics is also defined as the study and application of electrons and devices which operate by controlling the flow of electrons through them. Electronics can also be seen as devices which require the flow of electrons through conductors and semi-conductors in other to perform their functions. Anaemena (2000), stated that apart from the mass and charge of an electron, its other properties are highly paradoxical. This contradictory properties, behaviours and characteristics of electrons makes electrical and electronics subjects' teaching and learning very hazy, clumsy and sometimes confusing. Electrical and electronic systems being propelled by the invisible forces of electrons, charged particles of all sorts and electric current have their teaching and learning involving a great deal of mental abstractions, scientific ideals and technical skills on the part of both teachers and students. Based on the above high demands on teaching and learning processes of electrical and electronics subjects at the face of grave importance of electrical and electronics in the globalized civilized world, there is great need to improve the teaching and learning of electricity and electronics subjects at technical college level.

Anaemena (2001) greatly emphasized the importance of electricity and electronics in the present globalized civilized world and went ahead to mention some few applications as follows: usage in simple photoelectric relay, radios, television, radar, facsimiles, automatic gates, auto-vigilant door controls, complex computer systems, earoplane and spaceship controls, automatic control of industrial production line, and guidance control systems for missiles and all nuclear systems. Indeed electronics spans all academic disciplines and is important in medical research, geological explorations, geodesy, all branches of engineering, production control, quality control, aircraft design and operation, space exploration and the satellite

technology. There is hardly any industry that can be mentioned that does not apply electricity and electronics in one form or the others (Anaemena, 2000). In fact, without mixing words, if electricity and electronics are removed from the world today, the world will return back instantly to the total nudity of early age without any form of civilization, talk less of globalization.

Having noted the indispensable need of electrical and electronics to the continued existence of modern human race, it is imperative to investigate and implement the strategies for improving the teaching and learning of electrical and electronics subjects in Ebonyi State Technical colleges. This improvement has three principal elements, namely: teacher factor, student factor and instructional material factor. The first two factors will determine the extent the third factor can be used to improve the teaching and learning of electrical and electronics subjects. Though Peter in Ogbunanya and Abdullahi (2014) stated that electrical laboratory equipment are the backbone of effective teaching in science, technology, engineering and vocational courses: yet their efficacy in improving any teaching and learning activity depends on teachers and students factors.

The problem of this study is that the general and specific strategies for improving the teaching and learning of electrical and electronics subjects at technical college level had never been taken seriously by anybody neither had there been any empirical evidence for these strategies necessary to bequeath the great importance of electricity and electronics in the globalized economy by reducing students failure rate in these subjects. The general purpose of this study is to investigate the strategies for improving the teaching and learning of electrical and electronics subjects in Ebonyi State technical colleges in South Eastern Nigeria.

2. Research Question

This study was guided by the following research questions.

1. What are the strategies for improving the teaching of electrical and electronics subjects in Ebonyi State technical colleges?
2. What are the strategies for improving the learning of electrical and electronics (E/E) subjects in Ebonyi State technical colleges?

3. Hypotheses

The following null-hypotheses were formulated to guide this study at 0.05 level of significance.

H_{o1}: There will be no statistical significant difference between the mean responses of electrical and electronics teachers and the mean responses of electrical and electronics students on the strategies for improving the teaching of electrical and electronics subjects.

H_{o2}: The mean responses of electrical and electronics teachers will not be significantly different from those electrical and electronics students on the strategies for improving the learning of electrical and electronics subjects in Ebonyi State technical colleges.

4. Methodology

The design adopted in this study was survey. The area of the study was Ebonyi State of Nigeria with a population of 775 electrical and electronics teachers and students from the three technical colleges that offer electrical and electronics subjects. A sample of 240 subjects was drawn from the population universe using simple random sampling technique. The sample was made up of 24 teachers and 216 students. The instrument used for data collection was structured questionnaire developed by the researcher using a four-point response scale of strongly agree (4), agree (3), disagree (2) and strongly disagree (1). The instrument was validated and its reliability (r = 0.92) coefficient was established using Cronbach alpha measure of internal consistency.

The instrument was administered by hand with the aid of three research assistants. Out of the 240 questionnaire copies 228 were correctly completed representing 95% return. Mean and standard deviation were used to answer the research questions while student t-test statistic was used to test the hypotheses at 0.05 level of significance.

5. Results

The results of the research data analysis are presented in tables below in line with the research questions and hypotheses.

5.1 Research Question 1

What are the strategies for improving the teaching of electrical and electronics subjects in Ebonyi State technical colleges?

Table 1: Mean and standard deviation of responses on the strategies for improving the teaching of electrical and electronics subjects

S/N	Item Statement	$\bar{x}$	SD	Remark
1	Improving teachers' regular attendance to electrical and electronics lessons through salary increment.	3.59	0.51	Agree
2	Recruitment of only conscientious and highly efficient electrical and electronics teachers that can offer improved teaching of electrical and electronic subjects.	2.58	0..22	Agree
3	Recruitment of highly resourceful and creative electrical and electronics teachers that can continually improve on their teaching.	3.50	0.77	Agree
4	Ensuring that only technically qualified and registered professional electrical teachers are recruited that can diversify and improve electrical teaching.	3.80	0.63	Agree
5	Improving teachers classroom organization and management	2.79	0.32	Agree
6	Conducting effective formal induction of newly recruited electrical electronics teachers to ensure improved electrical and electronics teaching.	3.72	1.03	Agree
7	Ensuring that electrical electronics teachers employ scientific and improved teaching methods.	2.64	1.08	Agree
8	Ensuring that electrical and electronics teachers are interactive in their teaching strategies.	3.55	1.11	Agree
9	Sending electrical and electronics teachers for regular in-service training to acquire new skills and knowledge necessary for improved teaching.	3.48	0.37	Agree
10	Sending electrical and electronics teachers for regular conferences, workshops and seminars to acquire new skills and knowledge necessary for improved teaching.	3.88	1.12	Agree
11	Providing adequate security measures/services that will enable electrical and electronics teachers improve on their teaching.	2.69	0.33	Agree
12	Providing fund for electrical and electronics teachers' health care services necessary for improved teaching.	3.83	0.92	Agree
13	Providing adequate instructional materials, machines and equipment necessary for improved electrical and electronics teaching.	3.94	0.38	Agree
14	Encouraging electrical and electronics teachers to improvise instructional materials necessary for improved teaching.	3.22	0.51	Agree
15	Motivating teachers to improve electrical and electronics teaching through positive reward system.	3.66	1.01	Agree
16	Motivating teachers to improve electrical and electronics teaching through general welfare services and adequate provisions.	2.87	1.11	Agree
17	Encouraging teachers to employ effective formative evaluation for improved teaching.	3.01	1.03	Agree
18	Providing adequate electrical and electronics literature and library services to teachers for improved teaching.	2.79	1.08	Agree
19	Providing adequate consumables for improved electrical and electronics teaching to the teachers.	3.68	1.02	Agree
20	Improving electrical and electronics teaching through efficient and effective instructional supervision	3.81	0.80	Agree

5.2 Research Question 2

What are the strategies for improving the learning of electrical and electronics (E/E) subjects in Ebonyi State technical colleges?

Table 2: Mean and standard deviation of responses on the strategies for improving the learning of electrical and electronics (E/E) subjects

S/N	Item Statement	$\bar{x}$	SD	Remark
21	Electrical and electronics (E/E) subjects learning can be improved by admitting only qualified students.	3.47	0.53	Agree
22	Boosting students' interest through interactive lesson delivery improves learning.	3.08	0.88	Agree
23	Improving teacher and students relationship improves learning.	3.43	0.62	Agree
24	Encouraging students to participate freely in lesson delivery improves students learning.	3.26	0.91	Agree
25	Encouraging students to demonstrate with productive instructional materials improves their learning.	3.93	0.81	Agree
26	Provision of good classrooms and their equipment encourages students to improve their learning.	3.18	0.97	Agree
27	Provision of efficient laboratories and workshops makes students to improve in their learning.	2.86	1.02	Agree
28	Provision of students' health care services and facilities helps students to improve in their studies.	3.85	0.46	Agree
29	Provision of efficient hostel accommodation helps students to be punctual to lessons and thereby improve their learning.	3.01	0.98	Agree
30	Provision of efficient transportation services helps students to be punctual to lessons and thereby improve their learning.	3.66	1.21	Agree
31	Free education services help students to improve their learning of electrical and electrical subjects.	3.96	0.56	Agree

5.3 Hypothesis 1

There will be no statistical significant difference between the mean responses of electrical and electronics teachers and the mean responses of electrical and electronics students on the strategies for improving the teaching of electrical and electronics subjects.

Table 3: T-test of difference between the mean responses of electrical electronics teachers and those of electrical and electronics students on the strategies for improving the teaching of electrical and electronics subjects in technical colleges

S/N	Item Statement	$\bar{x}_t$	$\bar{x}_s$	t-cal	Remark
1	Improving teachers' regular attendance to electrical and electronics lessons through salary increment.	3.60	3.58	0.64	NS
2	Recruitment of only conscientious and highly efficient electrical and electronics teachers that can offer improved teaching of electrical and	2.61	2.55	0.82	NS
3	Recruitment of highly resourceful and creative electrical electronics teaches that can continually improve on their electrical and electronics teaching.	3.37	3.63	1.66	NS
4	Ensuring that only technically qualified and registered professional electrical teachers are recruited that can diversify and improve electrical teaching.	3.88	3.72	1.25	NS
5	Improving teachers classroom organization and management	2.86	2.72	1.20	NS
6	Conducting effective formal induction of newly recruited electrical and electronics teachers to ensure improved electrical and electronics teaching.	3.67	3.77	0.98	NS
7	Ensuring that electrical and electronics teachers employ scientific and improved teaching method.	2.73	2.55	1.37	NS
8	Ensuring that electrical and electronics teachers are interactive in their teaching strategies.	3.61	3.49	1.14	Ns
9	Sending electrical electronics teachers for regular in-service training to acquire new skills and knowledge necessary for improved teaching.	3.60	3.36	1.61	NS
10	Sending electrical and electronics teachers for regular conferences, workshops and seminars to acquire new skills and knowledge necessary for improved	3.92	3.84	0.86	NS
11	Providing adequate security measures and services that will enable electrical and electronics teachers improve on their teaching.	3.01	2.37	3.88	S
12	Providing fund for electrical and electronics teachers' health care services necessary for improved teaching.	3.89	3.77	1.14	Ns
13	Providing adequate instructional materials, machines and equipment necessary for improved electrical and electronics teaching.	3.98	3.90	0.86	NS
14	Encouraging electrical and electronics teacher to improvise instructional materials necessary for improved teaching.	3.24	3.20	0.71	NS
15	Motivating teachers to improve electrical and electronics teaching through positive reward system.	3.72	3.60	1.14	NS
16	Motivating teachers to improve electrical and electronics teaching through general welfare services and adequate provisions.	3.80	3.52	2.06	S
17	Encouraging teachers to employ effective formative evaluation for improved teaching.	2.81	3.21	2.90	S
18	Providing adequate electrical and electronics literature and library services to teachers for improved teaching.	2.84	2.74	0.98	Ns
19	Providing adequate consumables for improved electrical and electronics teaching to the teachers.	3.76	3.60	1.25	NS
20	Improving electrical and electronics teaching through efficient and effective instructional supervision	3.91	3.71	1.55	NS

Key:

$\bar{x}_t$: = Mean responses of E/E teachers ($N_t = 24$)

$\bar{x}_s$: = Mean responses of E/E students (Ns = 204)

df = Degree of freedom = $N_1 + N_2 - 2 = (24+204-2)$ = 226

T-table = 1.96 for two-tail, df > 100 and p < 0.05

NS = Not significant

S = Significant

5.4 Hypothesis 2

The mean responses of electrical and electronics teachers will not be significantly different from those of E/E students on the strategies for improving the learning of E/E subjects in Ebonyi State technical colleges.

Table 4: T-test of Difference between the Mean Responses of Electrical and Electronics Teachers and those of Electrical and Electronics Students on the Strategies for Improving the Learning of Electrical and Electronics Subjects in Ebonyi State Technical Colleges

S/N	Item statement	$\bar{x}_t$	$\bar{x}_s$	t-cal	Remark
21	Electrical and electronics (E/E) subjects learning can be improved by admitting only qualified students.	3.64	3.30	2.86	S
22	Boosting students' interest through interactive lesson delivery improves learning.	2.95	3.21	1.66	NS
23	Improving teacher and students relationship improves learning.	3.48	3.38	0.98	NS
24	Encouraging students to participate freely in lesson delivery improves students learning.	3.40	3.12	2.06	S
25	Encouraging students to demonstrate with productive instructional materials improves their learning.	3.87	3.99	1.14	NS
26	Provision of good classrooms and their equipment encourages students to improve their learning.	3.56	2.80	3.92	S
27	Provision of efficient laboratories and workshops makes students to improve in their learning.	3.40	2.32	4.86	S
28	Provision of students' health care services and facilities helps students to improve in their studies.	3.80	3.90	0.86	NS
29	Provision of efficient hostel accommodation helps students to be punctual to lessons and thereby improve their learning.	2.81	3.21	2.90	S
30	Provision of efficient transportation services helps students to be punctual to lessons and thereby improve their learning.	3.36	3.96	3.80	S
31	Free education services helps students to improve their learning of electrical and electrical subject.	3.94	3.98	0.71	NS

Key:

$\bar{x}_t$: = Mean responses of E/E teachers ($N_t = 24$)

$\bar{x}_s$: = Mean responses of E/E students ($N_s = 204$)

df = Degree of freedom = $N_1 + N_2 - 2 = (24+204-2)$ = 226

T-table = 1.96 for two-tail, df > 100 and p < 0.05

NS = No significant difference in means

S = Significant difference in means

6. Discussion

The findings of this study have revealed twenty principal strategies through which the teaching of electrical and electronic subjects can be improved in Ebonyi State technical colleges in Eastern Nigeria. Chief among these strategies is the process of improving teacher's regular attendance to E/E lessons through salary increment or attractive remuneration. Ogbu (2009) emphasized that if government and all concerned authorities can raise the salary and remunerations of technical teachers from the present low level to an attractive amount, E/E teachers will not only be punctual and regular to their teaching lessons; but the strategy will attract more qualified teachers into the teaching job. This item had a mean rating of 3.59 with standard deviation of 0.51 and t-cal of 0.64 indicating unanimous agreement among all the subjects.

Another finding worthy of note is the strategy of providing adequate instructional materials, machines and equipment necessary for improved E/E teaching; being item 13 in Table 1 with men of 3.94, standard deviation of 0.38 and t-cal of 0.86. This finding is in agreement with the great importance attached to the adequate provision, utilization and maintenance of instructional materials in the teaching and learning of any technical course offering (Inyiagu, 2010; Mohammad, 2010; Ogwa, 2010; Ogbuanya & Abdullahi, 2014). Other strategies for improving the teaching of E/E subjects will naturally be possible with the above two effectively achieved.

Two leading strategies for improving the learning of E/E subjects are listed in items 25 and 31 of Table 2. The first one was the strategy of encouraging students to demonstrate with productive instructional materials during the teaching learning process. This finding is in line with Ogwa (2002) who maintained that students will learn more by participating in practical demonstration with instructional materials.

7. Recommendations

Based on the findings of this study, the following recommendations were made.

1. Ebonyi state government and NBTE supervisors should implement without delay all the found strategies for improving the teaching of E/E subjects in the state.
2. Ebonyi State government should implement all the strategies for improving the learning the learning of E/E subjects.

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