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Course Contents Analysis of Students' Academic Performance in Basic Electronics

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Abstract. Year 1 Physics students in a College of Education (Technical) were sampled to analyze students' performance based on course content in basic electronics. End of semester examination marked scripts containing sixty multiple choice questions were used as a research instrument; frequency counts and percentage was used to analyze the data. Findings revealed that students' overall performance was not good; students' areas of weakness were fluorescent tube, vacuum tube amplifier, diode, energy band, p-n junction and transistor. However students' performances were better in discharge tube, cathode ray, CRO, integrated circuit and resistor colour code. The paper concluded that students' performance in basic electronic was determined by the course content and that students have difficulty in learning some aspects of basic electronics. Some recommendations were suggested based on the finding of the study; one of such recommendations was that Physics teachers should pay more attention to students' areas of weakness.

Keywords: Performance, Enrolment, Physics, Electronics

Introduction

Basic electronics is a course offered by Physics students in their first year in colleges of education. Physics has been a course that always has low enrolment and poor students' performance in all level of education (Aina, 2013). Physics is by nature mathematical and full of measurement this makes science educator like Omosewo (2009) regards it as a science of measurement. Performance of students in Physics has been very low as observed by many scholars (Aigbomian, 1994; Uguanyi, 1994; Aiyelabegan, 2003; Akanbi, 2003 and Kola, 2007). This poor performance is not limited to Nigeria alone as Wanbugu, Chiangeiywo and Ndirit 2013) observed that physics is a difficult subject among students in Kenya schools, not popular, avoided by students and with poor performances. Reasons for this poor performance vary as some think Physics is

abstract in nature Adeyemo (2010); others attributed it to teacher's strategy of teaching (Oladejo, Olosunde, Ojebisi and Isola, 2011).

Akanbi (2003) argued that poor performance in Physics is due to factors like shortage of science teachers in quality and quantity, inadequate laboratory equipment and facilities; poor teaching strategies and shortage of suitable Physics textbooks and other factors. Bamidele (2001) stressed that students themselves have lost interest in physics due to preconceived idea that Physics is a difficult subject, this has affected both enrolment and performance of students in physics.

Apata (2007) submitted that students taught by qualified and experienced teachers may likely perform better than students taught by unqualified and inexperienced teachers. Apart from teacher's qualifications, lack of good classroom management is also very important if students will learn well in physics class. Garba (2004) conducted a research on the relationship between classroom control and students' performance; his findings revealed that teachers who are sufficiently equipped with strategies that assist in classroom control adequately will automatically enable the students have full concentration and lead to positive academic performance of the students.

Physics is very important to national and economic development of nations; therefore no one should be comfortable if students are failing it. Sheriff, Maina & Umar (2011) said Physics is the most basic science, and its concepts and techniques support the progress of all other branches of science. National Commission for Colleges of Education (NCCE) in Nigeria has been coordinating Physics programme in colleges of education. According to NCCE (2008), Physics in colleges has many branches which are mathematics for Physics, electromagnetism, mechanics & properties of matter, acoustics, and introduction to Physics practical, others include thermal Physics, optics, basic electronics, Physics methodology, Physics practical, workshop practice, environmental Physics, atomic and quantum Physics.

Basic electronics is a course prescribed for Physics student in second semester in college of education. According to NCCE (2008), the course is made of passage of electricity in gases and in evacuated tubes, induced electricity and their uses, cathode rays, positive rays and their properties, simple electronic devices, diodes properties, Oscilloscope T.V. tubes, band theory of solids LC, energy level diagrams for conductors, semi-conductors and insulators, doping, types of semiconductors: P-types and N-types, P-N junctions, rectifying property of a p-n junction, forward and reverse biasing, simple transistors and oscillator circuits. Others include n-p-and p-n, basic structures and terminologies and their applications, colour coding, Integrated circuits (ICS). This study focused on basic electronics because is one of the branches of Physics that is not mathematical in nature at Nigeria Certificate in Education (NCE) level like other branches; yet students still performed very low. It is therefore a matter of concern to find out which aspect of this course did students find difficult to pass.

Research Design
The study adopted descriptive survey method of research where students' marked examination scripts in basic electronics are collected for analysis. The researcher collected all the marked examination scripts of all students of basic electronics from Physics department of College of Education (Tech.) Lafiagi after due permission from the course lecturer.

Participants
The population for this study were all Physics students from Colleges of Education (Technical) Lafiagi in Kwara State while the sampled population were all 50 NCE 1 Physics students who offered basic electronics.

Instrumentation
Research instrument for this study was End of Semester Basic Electronics Examination Marked Scripts (ESBEEMS); this examination mark scripts are in Multiple Choice format. The instrument had been giving to experts in Physics education to scrutinize for both face and content validity. The statistical analysis found suitable for this study was frequency counts and percentages. According to Daramola (2006), it is used for organizing and describing the characteristics of educational variables in concise and meaningful quantifiable terms.

Findings

Table1: Vacuum Tube

s/n	Question	% of correct answers
1	1	52
2	2	62
3	3	66
4	4	40
5	5	42
6	6	28
7	7	68
8	8	34
9	9	62
10	39	28
11	40	46
12	42	30
13	43	16
14	54	26
15	55	40
16	56	32

From Table 1, 16 questions were asked from vacuum tube and students did well in only 5 questions.

Table 2: Semiconductor Physics

s/n	Question	% correct answers
1	10	82
2	11	56
3	12	48
4	13	24
5	14	38
6	15	18
7	16	18
8	17	40
9	18	42
10	19	40
11	20	48
12	21	78
13	22	58
14	23	76
15	24	62
16	25	28
17	26	44
18	27	84
19	28	18
20	29	22
21	30	88
22	31	30
23	33	46
24	34	10
25	35	20
26	47	46

Table 2 revealed that 26 questions were asked from semiconductor Physics and student performed well in only 8 questions.

Table 3: Transistor

s/n	Question	% of correct answers
1	32	64
2	36	38
3	37	42
4	38	38
5	39	28
6	41	34
7	42	30
8	44	44
9	46	36
10	48	58

Out of 10 questions that were asked from transistor students did well in only two questions as shown in Table 3.

Table 4: Integrated Circuit

s/n	Question	% of correct answers
1	45	52
2	49	46
3	50	82
4	59	52
5	20	40

5 questions were asked from integrated circuit and students did well in 3 questions as indicated by table 4.

Table 5: Resistor Colour Code

s/n	Question	% of correct answers
1	51	40
2	52	66
3	53	58
4	57	78
5	58	52

Table 5 shows that 5 questions were asked from resistor colour code and students scored less than 50% in only 1 question.

The sixty objective questions were distributed as shown below:

Table 6: summary of course contents distribution

s/n	Course content	No of questions
1	Vacuum tube	14
2	Semiconductor physics	26
3	Transistor	10
4	Integrated circuit	5
5	Resistor colour code	5

Semiconductor Physics has the highest number of questions followed by vacuum tube and transistor; integrated circuit and resistor colour code have the same number of questions.

Table 7: topical distribution of questions in vacuum tube

s/n	Topic	No of questions	% of correct answers
1	Discharge tube	4	55.5
2	Fluorescent tube	2	34
3	Cathode ray	2	51
4	Cathode ray oscilloscope	1	62
5	Vacuum tube amplifier	5	32

From Table 7, 4 questions were asked from discharge tube and students did well in these questions; 2 and only 1 question were asked from cathode ray and CRO respectively with scores above 50% in both. 2 and 5 questions were asked from fluorescent tube and vacuum amplifier respectively with the scores of less than 40% in both.

Table 8: topical distribution of questions in Semiconductor Physics

s/n	Topic	No of questions	% of correct answers
1	Diode	5	49.5
2	Energy band	4	36.5
3	P-N junction	17	44.2

Table 8 reveals that 5 questions were asked from diode, 4 from energy band and 17 from p-n junction material with the scores of less than 50% in all the questions.

Table 9: topical distribution of questions in transistor

s/n	Topic	No of questions	% of correct answers
1	Transistor	10	41.2

Table 9 shows that the scores of all the 10 questions from transistor were less than 50%.

Table 10: topical distribution of questions in integrated circuit

s/n	Topic	No of questions	% of correct answers
1	Integrated circuit	5	54.4

From Table 10, integrated circuit had only 5 questions and the scores were 54.4%.

Table 11: topical distribution of questions in Resistor colour code

s/n	Topic	No of questions	% of correct answers
1	Resistor colour code	5	58.8

Resistor colour code had only 5 questions and 58.8% scores as shown in Table 11.

Table 12: Summary of performance based on topics in electronics

s/n	Topic	% pass
1	Discharge tube	55.5
2	Fluorescent tube	34
3	Cathode ray	51
4	Cathode ray oscilloscope (CRO)	62
5	Vacuum tube amplifier	32

6	Diode	49.5
7	Energy band	36.5
8	P-N junction	44.2
9	Transistor	41.2
10	Integrated circuit	54.4
11	Resistor colour code	58.8

From the summary in Table 12, it shows that only 47.2 % of the questions were got correct by the students. This table also clearly indicates that highest strength of the students comes from CRO with 62% and very weak in Vacuum tube amplifier with 32%.

Discussion

Findings above revealed areas of students' weakness and strength in basic electronics as highlighted below. Scores from fluorescent tube, vacuum tube amplifier, diode, energy band, p-n junction and transistor were less than 50%; this implies that students are weak in these areas of basic electronics.

Reasons for this weakness may be due to the nature of the topics; some of these deal with numbers, for instance transistor deals with number such as calculation of transistor gain. It has been observed by Aina (2013) that mathematical nature of Physics leads to students' poor performance in the subject.

Another reason that is obvious here was that most of these areas of students' weakness were very wide and therefore many questions were asked from there. Students showed some strength in discharge tube, cathode ray CRO, integrated circuit and resistor colour code because students' scores here were above 50%. The reason for this might be that the scope of these topics in basic electronic was very small and that is why their questions were also few. Generally, students' performance was not good as revealed that only 47.2% of the students' scores were correct.

Conclusion and recommendations

The findings of this study have revealed that students' performance in basic electronics was not good. The study observed that students' academic ability in basic electronics was weak in fluorescent tube, vacuum tube amplifier, diode, energy band, p-n junction and transistor and strong in discharge tube, cathode ray, CRO, integrated circuit and resistor colour code.

This study revealed that students' academic performance in basic electronic was determined by the subject content. The study also indicated that students of basic electronics from College of Education had problem in learning fluorescent tube, vacuum tube amplifier, diode, energy band, p-n junction and transistor.

The study concluded that weakness of student ability in those topics might be due to some of the topics that contain calculation and the large scope of some topics in basic electronics. This weakness might also be due to teacher's strategy of teaching. Most teachers do not make use of community resources for their teaching and this affects student understanding and performances in basic

electronics. Aina & Philip (2013) fully analyzed the potential of community resources in teaching and learning of Physics in their two papers - Harnessing the Potential of Community Resources as an Antidote to Poor Academic Performance in Physics and Imperative of Environment in Science Learning. It was affirmed in these papers that Physics teachers who failed to make use of resources available in their environment for teaching Physics will have poor students' academic performance in Physics.

The following recommendations are hereby suggested in the light of the above conclusion:

- Physics teachers should pay more attention to areas of students' weakness. Government should assist the college by sending Physics teachers to in-service courses specializing in fluorescent tube, vacuum tube amplifier, diode, energy band, p-n junction and transistor.
- Teachers should ensure the use of community resources for electronic teaching as there are many resources in Nigerian communities that can enhance students' learning
- Physics teachers should always attend seminars, workshops and conferences through which they could update their method of teaching. The idea of a Physics teacher being in classroom for more than a year without attending any conference or seminar for any reason should be discouraged.
- Government should ensure all schools are internet compliance so that students and teachers could always have access to modern electronic materials through the internet. At this age of Information Communication and Technology [ICT] all Physics teachers should be mandated to possess laptop for teaching and learning purpose.
- Electronics books should be written by indigenous authors because most of the textbooks written for electronics were written by foreign authors with language foreign to our students
- Government should equip our schools with modern electronic equipment that could be used to teach Physics electronics practically. We are in the era of Information Communication and Technology [ICT] where there are soft-wares that could be used to teach and demonstrates complex activities in basic electronic for students' better understanding.
- Students should be motivated through bursary and scholarship awards to any brilliant student in Physics electronics.
- Competent and qualified Physics teachers should always be employed to teach Physics; the idea of just leaving Physics teaching in the hand of any science teacher or engineer should stop.
- Physics teachers should teach electronics within the content of NCE curriculum this is necessary because electronics are taught at different level of our education; there is electronics for engineering students and also for telecommunication students but electronics at NCE level is for prospective Physics teachers.
- It will be very good to allow different teacher to teach different topic in Physics electronics through peer teaching. A teacher may not be very

good to teach transistor, let such teacher leave transistor to another teacher who could teach it better.

- Teacher should always give internet assignment and homework to students to encourage them seeks for information on their own. There are many simple uses of electronics devices like diodes, transistors etc on the net that can assist the student to learn.

Limitations

The sampled population for this study was small due to general low enrolment of students in Physics class in schools in Nigeria. The findings of this study may not be generalized but could be applied in other Colleges in the country.

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