A SURVEY OF DIFFICULTIES ENCOUNTERED IN TEACHING AND LEARNING SECONDARY SCHOOL NEW PHYSICS CURRICULUM

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Abstract
The study sought to investigate the teaching and learning difficulties in some content areas of the secondary school new physics curriculum. Twenty secondary schools in two Education zones of Anambra State were used for the study. Two separate questionnaires were administered to physics teachers and physics students. Data collected were analyzed using the mean and standard deviation. T-test was used to test the null hypothesis at 0.05 significant level. The study revealed that sixteen out of the thirty-five content areas of the new physics curriculum posed problems to both teachers and students in teaching and learning of physics effectively. Based on this finding, it was recommended among others, that the Ministry of Education should organize works/seminars for physics teachers on the content areas of the new physics curriculum that they find difficult to teach.

Introduction

The educational system in Nigeria has undergone quite some reasonable changes made with a view to make our education more functional than what we used to have. The latest of such changes was the launching of the new curriculum for all the senior secondary schools education in Nigeria by the Federal Government in March 2011. The curriculum known as Senior Secondary Schools Education Curriculum, SSEC, is aimed at producing secondary school graduates who are well prepared for higher education as well as having relevant functional trade and entrepreneurship skills needed for poverty eradication, job creation and wealth generation (Vanguard, 2011). The new SSEC commenced in September 2011 with the first batch of the Basic Education Certificate holders.

Physics, being one of the science subjects taught in senior secondary school, also has some changes in its curriculum. Unlike the former curriculum which was structured with the conceptual approach to content selection, the current senior secondary school physics curriculum is structured using the thematic approach in order to ensure compliance with national and global issues without necessarily overloading the content. The six themes, which have related concepts and topics, are:

i. interaction of matter, space and time;
ii. conservation principles;
iii. waves: motion without material transfer;
iv. fields at rest and in motion;
v. energy quantization and duality of matter;
vi. physics in technology (NERDC, 2008).

In order to stimulate creativity and develop process skills and correct attitudes in students, the new physics curriculum is student-activity oriented with emphasis on experimentation, questioning, discussion and problem-solving. The introduction of the theme: 'Physics in Technology' provides an opportunity for the construction and operation of workable devices as well as acquaintance with some products of modern technology. The new physics curriculum is unique in several respects. It is characterized by the following:

a. thematical organization of contents
b. spiral organization and sequencing of contents,
c. the use of guided inquiry in instruction,
d. broad-based curriculum contents,
e. student-activity oriented,
f. infusion of elements of technology in the curriculum packages,
g. vocationalization of physics education for entrepreneurship development (NERDC, 2008).

Against each of the topics under the themes are series of recommended students activities. The purposes of the present study are to:

1. identify those areas in the new secondary school physics curriculum the teachers find difficult to teach;
2. identify those areas in the new secondary school physics curriculum the students find difficult to understand;
3. compare the difficult content areas of the teachers with those of the students.

Based on these, two research questions and one null hypothesis were formulated.

Research Question

1. What content areas of the new senior secondary school certificate physics curriculum do teachers find difficult to teach?
2. To what extent do the content areas identified as difficult by the teachers compare with those of the students?

Hypothesis

Ho_1: There is no significant difference between the areas the teachers experience difficulty in teaching and those the students experience difficulty in understanding.

Method

This is a survey carried out in the 80 public secondary schools of two education zones of Anambra State. The study covered all the local government areas that make up the two education zones. The two Education zones were Onitsha and Nnewi.

The sample was made up of 200 senior secondary school year III physics students (SS3) and forty-five (45) physics teachers drawn from schools in the two education zones. Ten (10) secondary schools were selected from each zone through simple random sampling from the list of schools in the zones. In each of the schools, 10 physics students in senior secondary III (SS3) were selected using simple random sampling. A total of 23 physics teachers were randomly selected from the sample schools in Nnewi Education zone while 22 physics teachers were picked from Onitsha Education zone.

The instrument used for the study comprised two separate structured questionnaires, administered to physics students and physics teachers to collect data on the content areas of the new senior secondary school physics curriculum which pose difficulty in teaching and learning. Since the instrument was structured from the content of the new physics curriculum and thus, was a standardized instrument, no further validity or reliability test was done.

The instrument was administered by the researcher using on-the-spot method. The respondents were requested to draw the attention of the researcher if they had any problem in the process of responding to the instrument. The rating scale for the questionnaire was from 1 to 4 in ascending order of importance, and

the mean point scale was computed to be 2.50. The data collected were analysed using mean, standard deviation and t-test.

Result

Research Question 1: What content areas of the new senior secondary school certificate physics curriculum do teachers find difficult to teach?

Table 1: Mean distribution and standard deviation of the rating of areas of new physics curriculum teachers experience difficulty in teaching.

S/N	Content Areas	Mean X	SD
1	Physics in technology	3.14	0.113
2	Energy quantization	3.12	0.112
3	Simple A.C. Circuit	3.06	0.098
4	Wave particle paradox	3.00	0.090
5	Nucleus	2.98	0.886
6	Electromagnetic field	2.96	0.084
7	Electromagnetic waves	2.88	0.069
8	Simple Harmonic motion	2.80	0.056
9	Crystal structure	2.78	0.050
10	Magnetic field	2.76	0.049
11	Models of atom	2.74	0.046
12	Elastic properties of solid	2.71	0.041
13	Gravitational field	2.63	0.027
14	Projectiles	2.58	0.016
15	Description and properties of fields	2.56	0.015
16	Electric charges	2.54	0.013
17	Equilibrium of forces	2.51	0.007
18	Production and propagation of waves	2.50	0.005
19	Light waves	2.47	0.006
20	Particle nature of matter	2.43	0.007
21	Linear momentum	2.41	0.010
22	Heat energy	2.38	0.018
23	Sound waves	2.37	0.017
24	Fluids at rest and in motion	2.26	0.035
25	Properties of waves	2.22	0.046
26	Time	2.14	0.056
27	Fundamental and derived units	2.10	0.063
28	Scalars and vectors	2.02	0.079
29	Motion	1.90	0.096
30	Position, distance and displacement	1.89	0.098
31	Speed and velocity	1.80	0.113
32	Mechanical energy	1.78	0.120
33	Rectilinear acceleration	1.75	0.123
34	Work, energy and power	1.74	0.123
35	Simple machines.	1.72	0.126

Table 1 shows that 'Physics in Technology' tops the list with mean of 3.14 and 0.113 standard deviation. This is followed by 'Energy quantization' with 3.12 mean mark and 0.112 standard deviation and the least is the 'Simple machines' with mean of 1.72 and 0.126 standard deviation. This implies that the content areas corresponding to items nos 1-18 on Table 1 above are those the teachers experience difficulty in teaching in the new physics curriculum. The rest of the items have means below 2.50 which means that these areas were not identified as difficult by the teachers.

Research Question 2

To what extent do the content areas identified as difficult by the teachers compare with those of the students?

Table 1: Mean distribution and standard deviation of the rating of areas of new physics curriculum teachers/students experience difficulty in understanding.

S/N	Content Areas	Teachers Mean X	SD	Students Mean X	SD
1	Physics in technology	3.14	0.113	3.39	0.158
2	Energy quantization	3.12	0.112	2.12	0.114
3	Simple A.C. Circuit	3.06	0.098	2.70	0.044
4	Wave particle paradox	3.00	0.090	3.27	0.140
5	Nucleus	2.98	0.886	3.00	0.075
6	Electromagnetic field	2.96	0.084	2.79	0.059
7	Electromagnetic waves	2.88	0.069	2.72	0.046
8	Simple Harmonic motion	2.80	0.056	2.45	0.006
9	Crystal structure	2.78	0.050	2.75	0.054
10	Magnetic field	2.76	0.049	2.55	0.020
11	Models of atom	2.74	0.046	2.58	0.023
12	Elastic properties of solid	2.71	0.041	2.61	0.029
13	Gravitational field	2.63	0.027	2.76	0.054
14	Projectiles	2.58	0.016	2.31	0.023
15	Description and properties of fields	2.56	0.015	2.83	0.064
16	Electric charges	2.54	0.013	2.69	0.042
17	Equilibrium of forces	2.51	0.007	2.46	0.007
18	Production and propagation of wave	2.50	0.005	2.50	0.012
19	Light waves	2.49	0.006	2.44	0.005
20	Particle nature of matter	2.43	0.007	2.21	0.037
21	Linear momentum	2.41	0.010	2.20	0.039
22	Heat energy	2.38	0.018	2.43	0.005
23	Sound waves	2.37	0.017	2.34	0.016
24	Fluids at rest and in motion	2.26	0.035	2.71	0.045
25	Properties of waves	2.22	0.046	2.42	0.004
26	Time	2.14	0.056	1.91	0.089
27	Fundamental and derived units	2.10	0.063	1.98	0.078
28	Scalars and vectors	2.02	0.079	2.00	0.074
29	Motion	1.90	0.096	2.07	0.064
30	Position, distance and displacement	1.89	0.098	1.81	0.106
31	Speed and velocity	1.80	0.113	1.82	0.107
32	Mechanical energy	1.78	0.120	1.78	0.119
33	Rectilinear acceleration	1.75	0.123	2.25	0.031
34	Work, energy and power	1.74	0.123	1.92	0.087
35	Simple machines.	1.72	0.126	1.65	0.120

Table 2 shows that the means of 2.50 and above were obtained from items nos 1-16. This implies that the content areas corresponding to these items are the areas that students experience difficulty in understanding in the new physics curriculum. The rest of the items have means below 2.50 implying that those content areas were not found difficult by the students.

The teachers identified a total number of eighteen (18) items as areas they experience difficulty in teaching and their students identified sixteen (16) items. Sixteen (16) items out of the eighteen (18) respective items were identified by both teachers and students. This gives 78% level of agreement with respect to total number of sixteen (16) items identified by the two groups. The teachers and students each identified two(2) items not identified by the other which constitute 23% of the whole items identified. The disparity level is so much less than the agreement level. Hence, the areas of the new physics curriculum identified by the teachers compared very highly with the areas identified by the students, thus answering the research question 2. The areas common to both groups are:

1. Physics in technology
2. Wave particle paradox
3. Energy quantization
4. Nucleus
5. Description and properties of fields
6. Electromagnetic field
7. Gravitational field
8. Crystal structure
9. Electromagnetic waves
10. Fluids at rest and in motion
11. Simple A.C. Circuit
12. Electric charges
13. Elastic properties of solid
14. Models of atom
15. Magnetic field
16. Production and propagation of waves

Areas of Disagreement are:

1. Simple Harmonic Motion
2. Projectiles

Hypothesis

Ho1: There is no significant difference between the areas the teachers experience difficulty in teaching and those the students experience difficulty in understanding.

Table 3: T-test comparison of areas the teachers experience difficulty in teaching and those the students experience difficulty in understanding.

Respondents	No	Grand mean (x)	Grand SD	t-cal	t-crit	Df	Decision
Teachers	45	2.45	0.060	0.8108	1.9600	243	Accepted Null Hypothesis
Students	200	2.44	0.057				

From Table 3, the calculated t-statistics (0.8108) is less than the critical value of t, (1.9600) at 243 df and 5% level of significance. Hence, the null hypothesis is accepted. Thus, there is no significant difference between the areas the teachers experience difficulty in teaching and those the students experience difficulty in understanding.

Discussion

Table 1 reveals that eighteen (18) out of thirty-five (35) areas of the new physics curriculum were identified as posing difficulty to the teachers. From table 2, it is quite clear that both teachers and students agreed on sixteen (16) out of the eighteen (18) of the content areas. Physics in technology, energy quantization, wave particle paradox, nucleus, description and properties of fields, etc. were rated areas of most difficulty by both physics teachers and physics students while simple machine was rated the least difficult by both groups. The result was in agreement with the findings of Nwoji (2002) and Dickson (2003) that students experience difficulty in understanding some of the concepts in physics like wave-particle duality, Bohr's models of atom, energy quantization, radioactivity, half life of radio active, half life of radioactive substance, etc. Also, Ezeanowii (2014) opined that physics teachers' understanding of some physics concepts such as electricity, waves and fields is very poor.

Table 3 suggests that there is no significant difference between the areas the teachers experience difficulty in teaching and those the students experience difficulty in understanding. The calculated t-statistics (0.8108) is less than the critical value of t (1.9600) at 0.05 level of significance. The null hypothesis was therefore, accepted. Hence, Murphy and Whitelogy (2006) concluded that both teachers and students generally experience some difficulties in understanding some concepts in physics.

Conclusion

Based on the discussion, it can be concluded that:

1. both teachers and students experience some difficulties in teaching and learning some content areas in the new physics curriculum;
2. there is no significant difference in the content areas of the new physics curriculum the teachers find difficult to teach and those that the students find difficult to understand.

Recommendations

1. The Ministry of Education should organize workshops/seminars for physics teachers on the content areas of the new physics curriculum that they difficult to teach.
2. Government and the Ministry of Education should make available in secondary schools textual materials that deal explicitly with difficult content areas of the new physics curriculum.
3. Computer Assisted Instruction (CAI) packages, in the form of simulation packages, of the difficult content areas of the new physics curriculum can be supplied to schools by government and schools administrators in order to be used for instruction. This will go a long way in concretizing the topics in the difficult content areas since majority of them are too abstract to understand.
4. Physics teachers as well as students should devote more time of study to these difficult content areas than to other areas of the new physics curriculum.

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