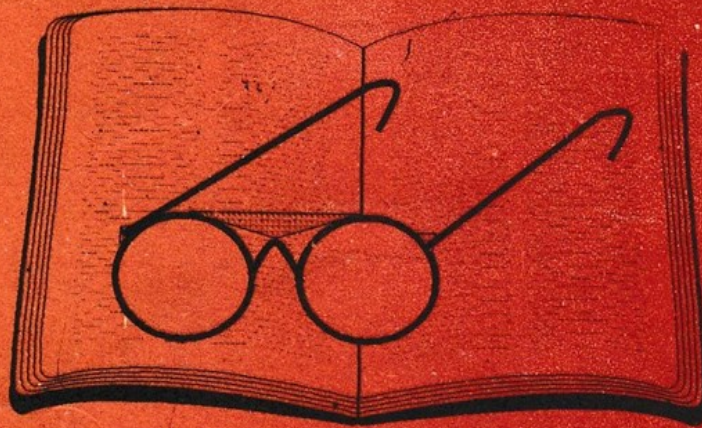


THE
RESEARCHER

• JOURNAL OF NIGERIAN EDUCATION
RESEARCH REPORTERS' ASSOCIATION



Volume 1, No. 1

September, 1996

DIFFICULT CONCEPTS IN PHYSICS AS EXPERIENCED BY SENIOR SECONDARY STUDENTS IN AKWA IBOM STATE, NIGERIA

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ABSTRACT

The study aimed at investigating the level of difficulty Senior Secondary Physics students in Akwa Ibom State, Nigeria, have with concepts in the Physics Curriculum. One hundred and twenty-four (124) concepts were used. Physics students' and teachers' Questionnaires that required responses from students and teachers as to how they consider each concept as being difficult, were used. On the whole eighty (80) students and twenty (20) teachers responded to the Questionnaires. The selection of sample was done using a random sampling technique. The results obtained showed that most (77.42%) Physics concepts involved in the study were considered difficult by students. It was also seen that concepts considered as being either averagely difficult or very difficult by teachers were branded as being very difficult by students. To check the current poor performance c. Physics students in SSCI examinations, it is recommended that Physics educators and those involved in the training of Physics Teachers should pay much attention to the concepts so identified as being difficult in the study. Seminars and workshops are recommended for serving teachers.

INTRODUCTION

The consistent poor performance of students in Senior Secondary Certificate Examination in Physics, as reported yearly by WAEC Chief Examiners in the subject, poses a great threat to the development of Science and Technology in Nigeria. Physics teachers and educators should view this occurrence with a great concern. Literature is replete with the causes of poor performance in science generally. These include, insufficient manpower, lack of equipment, poor attitude of students, poor understanding of the concepts involved, among others.

The instrument used were Physics Students Questionnaire (PSQ) and Physics Teacher Questionnaire (PTQ). PSQ had one hundred and twenty four (124) items that cut across every area of the Secondary Physics curriculum. There were forty-seven (47) items on Mechanics; eight (8) items on Heat; eighteen (18) on Optics; eight (8) on Sounds; six (6) on Waves; nineteen (19) on Electricity; eleven (11) on Nuclear Physics; and seven (7) on Magnetism. The Questionnaire was structured with 4-point Likert Scale with the following key:

- 1 - Very Simple
- 2 - Simple
- 3 - Difficult, and
- 4 - Very difficult

The Questionnaire was face-validated by a team of experts. Physics teachers in their Questionnaire were allowed the freedom of writing down the concepts they considered difficult to teach in the Physics curriculum.

Analysis

Students' and teachers' responses were analysed using mean (\bar{X}), standard deviation (SD) and index of difficulty (w). These three measures were calculated for each item in the Questionnaires. The expression as follows:

$$\text{Index of difficulty } (w) = \frac{\text{Sum of responses indicating that the item is either difficulty or very difficulty}}{\text{Total number of responses}}$$

Thus for each item;

$$(w) = \frac{c + d}{N}$$

- Where c = Responses showing that the item is difficult
- d = Responses showing that the item is very difficult
- N = Total number of responses on the item

The indicates obtained for all items were classified as follows.

- $.00 \leq w < .31$ (Not difficult);
- $.31 \leq w \leq .63$ (Averagely difficult; and
- $w > .63$ (Very difficult)

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With respect to the mean values of the responses, classification of difficulty was done as follows:

$1.50 \leq X < 2.20$ (Not difficult);

$2.20 \leq X \leq 2.70$ (Averagely difficult); and

$X > 2.70$ (Very difficult)

Result and Discussion

The result of analysis of data per item is as shown on Table I below.

TABLE I: MEAN, STANDARD DEVIATION AND INDEX OF DIFFICULTY OF STUDENTS RESPONSES ON THE DIFFICULTY LEVEL OF OF CONCEPTS IN PHYSICS CURRICULUM

N = 80

S/N	CONCEPTS	MEAN, \bar{X}	SD	DIFFICULTY INDEX, ω	LEVEL OF DIFFICULTY
1.	Measuring instruments	1.56	0.61	.06	ND
2.	Speed and velocity	1.71	2.24	.00	ND
3.	Uniform velocity	1.56	0.55	.03	ND
4.	Scalar and Vector Quantities	1.75	0.66	.06	ND
5.	Rectilinear acceleration	2.16	0.72	.31	ND
6.	Uniform acceleration	1.73	0.55	.03	ND
7.	Equations of motion	2.20	0.88	.35	ND
8.	Types of motion	1.55	0.88	.11	ND
9.	Force, work and power	1.68	1.20	.05	ND
10.	Newton's Laws of motion	1.60	0.59	.14	ND
11.	Projectiles	2.68	0.90	.61	ND
12.	Density and volumes of regular and irregular objects	3.41	0.84	.75	VD
13.	Relative density of liquid	1.74	0.91	0.05	ND
14.	Definition and unit of Pressure	2.35	0.72	.41	ND
15.	Pressure on solids and liquids	2.64	2.61	.56	AD
16.	Pressure and depth	2.86	2.91	.65	VD
17.	Causes of atmospheric pressure	2.89	1.55	.65	VD
18.	Effect of atmospheric pressure	3.65	0.66	.85	VD
19.	Measurement of atmospheric pressure using difficult types of barometer	3.59	0.84	.76	VD
20.	Application of atmospheric pressure in various mechaical system	3.45	1.35	.74	VD
21.	Comparison of Relative Densities of two liquids using Hares apparatus	3.50	0.73	.76	VD
22.	Upthrust and pressure of liquid	2.69	1.52	.58	AD
23.	Upthrust and density of liquid	2.70	0.89	.59	AD
24.	Achimedes Principle	3.15	2.23	.69	VD

Key: SD = Standard deviation AD = Averagely difficult
 ND = Not difficult VD = Very difficult

S/N	CONCEPTS	MEAN, X	SD	DIFFICULTY INDEX, ω	LEVEL OF DIFFICULTY
25.	Relation between upthrust and weight of liquid displaced	2.63	1.88	.54	AD
26.	Verification of Archimedes Principles	2.80	0.85	.64	VD
27.	Application of Principle of floatation	2.61	1.12	.45	AD
28.	Principles of levers	2.62	2.20	.54	AD
29.	Moment of a force about a point	2.60	.85	.53	AD
30.	Determination of Relative density using principles of moment	2.70	1.15	.60	AD
31.	Centre of parallel forces	2.92	.95	.68	VD
32.	Centre of gravity of regular geometrical figures	3.25	1.18	.71	VD
33.	Stable, unstable and neutral equilibrium	2.72	2.60	.66	VD
34.	Limiting Friction	2.64	2.58	.55	AD
35.	Coefficient of friction	2.62	1.98	.50	AD
36.	Inclined plane and friction	2.45	1.62	.44	ND
37.	Methods of reducing friction	2.62	1.54	.45	AD
38.	Mechanical advantage of machine	2.19	0.66	.30	ND
39.	Efficiency of machines	1.95	0.92	.24	ND
40.	Mass and weight	1.60	0.38	.14	ND
41.	Elastic and inelastic collision	2.42	1.28	.43	AD
42.	Oscillatory and simple harmonic motion	2.35	0.78	.33	AD
43.	Frequency, amplitude, periodic time	2.31	0.75	.40	AD
44.	Simple and compound pendulum	2.22	1.29	.36	AD
45.	Determination of 'g' using the simple pendulum and spiral spring	2.2	2.16	.36	AD
46.	Transverse and longitudinal wave length	2.45	2.05	.45	AD
47.	Nature of waves - crest, trough, amplitude, wave length	2.32	1.75	.39	AD
HEAT					
48.	Differences between evaporation and vapourisation	1.55	0.98	.16	ND
49.	Differences between evaporation and cooling	1.62	0.46	.21	ND
50.	Heat capacity and specific heat capacity	1.68	1.22	.24	ND
51.	Latent heat and specific latent heat of fusion	2.25	1.09	.33	AD
52.	Calculation of specific latent heat of vapourisation and of fusion of ice	2.48	2.62	.38	AD

Key: SD = Standard deviation AD = Averagely difficult
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S/N	CONCEPTS	MEAN, \bar{X}	SD	DIFFICULTY INDEX, ω	LEVEL OF DIFFICULTY
53.	Conduction, convection, radiation and land and breezes	1.92	1.73	.24	ND
54.	Vapour pressure and Dew point Relative Humidity	1.88	1.33	.24	ND
55.	Determination of Boyles, Charles and Pressure laws	1.68	1.28	.25	ND
OPTICS					
56.	Verification of the law of Reflection	2.37	0.92	.33	AD
57.	Formation of images using curved mirrors	2.30	0.77	.33	AD
58.	Experimental determining of focal length and radius of curvature	2.45	1.28	.46	AD
59.	Laws of refraction	1.35	1.35	.25	ND
60.	Refractive Index	2.34	0.82	.33	AD
61.	Real and Apparent depth	2.56	1.28	.46	AD
62.	Total Internal Reflection	2.58	0.78	.50	AD
63.	Determination of the refractive index of liquid	2.52	0.56	.53	AD
64.	Lens formula and sign convention	2.62	0.63	.59	AD
65.	Determination of the focal length of a converging lens	2.47	1.34	.45	AD
66.	Defects of vision and their correction	2.58	1.82	.56	AD
67.	Types of microscopes	2.39	2.12	.38	AD
68.	Types of telescopes	2.38	1.28	.41	AD
69.	Dispersion by a Prism	2.68	0.95	.59	AD
70.	Production of a pure Spectrum	2.69	0.65	.58	AD
71.	Formation of the Rainbow	2.74	0.48	.68	VD
72.	Additive and subtractive colour mixing	2.72	1.25	.66	VD
73.	Light as part of the electro- magnetic spectrum	3.38	1.38	.73	VD
SOUND					
74.	Need for a material Medium	3.15	1.44	.71	VD
75.	Limits of Audibility	2.66	2.28	.65	VD
76.	Reflection of Sound	2.58	0.76	.50	AD
77.	Speed of sound	2.54	0.82	.53	AD
78.	Refraction of sound	2.43	1.28	.40	AD
79.	Vibrations of a string - The sonometer	2.55	2.13	.56	AD

Key: SD = Standard deviation
ND = Not difficult

AD = Averagely difficult
VD = Very difficult

S/N	CONCEPTS	MEAN, \bar{X}	SD	DIFFICULTY INDEX, ω	LEVEL OF DIFFICULTY
NUCLEAR PHYSICS					
107.	Models of the Atom	2.52	1.28	.54	AD
108.	Spectra and energy quantization	3.28	0.66	.75	VD
109.	Optical and Emission spectra	2.75	0.87	.65	VD
110.	Radioactivity	2.72	0.95	.61	AD
111.	Nuclear fusion and fission	2.38	0.68	.49	AD
112.	Half life	2.48	0.45	.51	AD
113.	Atomic number and mass number	2.44	1.35	.48	AD
114.	Alpha and Beta decay	2.53	1.28	.59	AD
115.	Gamma emission	2.75	0.54	.64	VD
116.	Artificial radio activity	2.77	0.68	.65	VD
117.	Mass energy and nuclear fission	2.68	0.28	.61	AD
MAGNETISM					
118.	Magnetic field	1.78	1.25	.30	ND
119.	Magnetic force	2.22	0.86	.35	AD
120.	Electromagnetic	2.76	1.28	.63	VD
121.	Interaction between magnetic field and currents in wires and solenoid	3.25	1.66	.72	VD
122.	Moving coil instruments	2.64	0.78	.55	AD
123.	Moving iron instruments	2.68	0.92	.58	AD
124.	Using a galvanometer both as an ammeter and voltmeter	2.90	1.63	.65	VD

Key: SD = Standard deviation AD = Averagely difficult
 ND = Not difficult VD = Very difficult

As shown in Table I above, using both the mean responses and the index of difficulty, twenty-eight (28) concepts were considered not difficult (ND); sixty-eight (68) as averagely difficult (AD) and twenty-eight (28) as being very difficult (VD) by Senior Secondary III Physics students in Akwa Ibom State.

This, on the whole, shows that Physics students find most concepts in the Physics curriculum as being difficult. This therefore explains the cause of consistently poor performance in SSCE Physics every year among our students. The poor understanding of the concepts can be attributed to a number of factors within and outside the school system.

TABLE II: MEAN, STANDARD DEVIATION AND INDEX OF DIFFICULT OF TEACHERS RESPONSES

N = 20

S/N	DIFFICULT CONCEPTS	MEAN, \bar{X}	S.D.	DIFFICULTY INDEX, ω	LEVEL OF DIFFICULTY
1.	Alternative current	2.38	1.28	.42	AD
2.	Optical and Emission spectra	2.88	0.76	.68	VD
3.	Radioactivity	2.28	0.85	.38	AD
4.	Artificial radioactivity	2.43	1.28	.45	AD
5.	Root mean square values	2.82	1.38	.65	VD
6.	Polarization of transverse	2.80	1.42	.66	VD
7.	waves	1.48	0.92	.28	ND
8.	Thermal conductivity Magnestism	3.15	1.38	.72	VD

Key: SD = Standard deviation AD = Averagely difficult
 ND = Not difficult VD = Very difficult

In Table II, analysis of teachers' responses show that out of eight (8) concepts listed by Physics as being difficult, one was found not to be difficult (ND), three (3), averagely difficult (AD) and four (4), very difficult (VD).

It is interesting to note that there exist a postive relationship between students and teachers responses. Concepts considered either averagely (1,3,4) or very difficult (2,5,6,8) by teachers in Table II are seen by students as being very difficult (87, 106, 109, 116) in Table I. This is understanding because if a concepts is difficult to a teacher then the presentation to the students must be poor and the students will find it difficult to understand the concept.

Conclusion and Recommendation

From the study, it is alarming to discover that most Physics concepts in school are regarded by students as being difficult. Out of the 124 concepts considered in the study, twenty-eight (28) (22.58%) were found not difficult by Physics student. Ninety-six (96) (77.42%) of the concepts were considered difficult. It is no wonder that results of students in Physics in Senior Secondary Certificate Examinations remain poor every year.

It is recommended that Physics edcuators and those involved in the training of Physics teachers should particularly concentrate in the area of difficulty indicated in the study. Ways and means of getting Physics teachers in training to fully understand the concepts should be developed. Practising Physics teachers should be exposed to regular seminars and workshops where appropriate techniques of teaching the concepts are emphasised. Above all, it is necessary to investigate the possible causes of difficulty experienced by students in each of the concepts involved.

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