

## Challenges towards Transformation of Secondary School Physics Curriculum in Nigeria

**Rev. Canon Chris N. Mbah, Ph.D**

School of General Studies

Imo State Polytechnic, Umuagwo

[Chrismabah05@yahoo.com](mailto:Chrismabah05@yahoo.com)

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### **Abstract**

*Physics, found to be the bedrock of scientific and technological development globally in both developed and developing nations involves some features that are generally accepted and believed to widen the knowledge and increase the understanding of the learners if duly and critically followed and applied in any given situation and period. But transformations made in the physics curriculum over the years with view to making physics simple and easy for the students and relevant to the societal norms and values had been successful with some teething challenges in the implementation stages. This study, therefore presents the challenges towards secondary school physics curriculum transformation in Nigeria. To guide the study two research questions and hypotheses each were addressed and formulated. The study adopted descriptive and inferential design with a 15-item instrument of Likert form named SCTRASPC. A sample of 600 physics students with 32 physics teachers were purposively selected from government owned secondary schools in Imo State to complete the instrument with reliability coefficient of 0.71. The findings showed that government inadequate provisions of resource materials and teachers' inactions in teaching constitute challenges to a great extent. In the light of the findings and their implementations, recommendations were made to eliminate the challenges.*

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**Keywords:** Challenges, Transformation, Curriculum, Resource Materials, Inaction.

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### **Introduction**

Physics is one of the sciences that contribute to the technological and industrial developments of a nation. It has been found to be the most basic science for the developments worldwide that both development and developing countries like USA and Nigeria have realized the impact of physics in national development.

Knowledge acquired from the study of physics is used to discover and explain the order of the physical environment in a wide range of disciplines like medicine, energy, industries, telecommunication and management of the environment. The study of physics therefore is essential for any study considering a carrier involving scientific knowledge and critical thinking in solving problems.

### **Transformation**

Transformation is a fundamental shift in the deep orientation of a person or an organization or study or state such that the world is seen in new ways and new actions and then results that were impossible become possible (Mbah, et al, 2015). They further opined that transformation is a mandate or a radical, structural and fundamental re-arrangement and re-ordering of the building blocks of a nation or document. Put simply, transformation is a change in form or appearance or nature of someone or something.

## **Original Form of Physics Curriculum**

Physics curriculum was originally organized under the units: Mechanics; Properties of Matter: Heat, Waves; Sound and Light; Electricity and Magnetism and Modern Physics. Under this guide and form, each unit was exhausted before starting a new or next unit.

The general objectives of the curriculum as stated in the curriculum document of 1985 by the Federal Ministry of Education and revised 1998 were;

1. To provide basic literacy in physics for functional living in the society.
2. To stimulate and enhance creativity
3. To acquire essential skills and attitudes as a preparation for technological application of physics
4. To acquire basic concept and principles of physics as preparation for further studies.

## **Transformation of Physics Curriculum:**

It is based on the National Policy on Education, NPE guidelines of 1981 that there has been need for curriculum transformations in order to take into consideration the changes taking place in the nations as well as in the world. The transformed curriculum would be responsible to the societal needs and be updated to include new knowledge. Such issues as introduction of new technologies need to be appropriately addressed in the curriculum. Again curriculum transformation would take into consideration the availability of teaching and learning resources and the support facilities such as laboratories and computer facilities (Adeyemo, 2010).

Therefore, over the years efforts have been made from various contributions of science educators and different educational bodies such as WAEC, STAN and Nigerian Educational Research and Development Council (NERDC) towards transforming Physics curriculum to make physics simple and easy for students to understand. The first of such transformations was the unification of the physics topics into five major concepts.

Four approaches were stated for selecting topics which were conceptual, thematic, modular and the traditional topical approach. After critical discussions on the rationale for selection of topics, the conceptual approach was adopted. Conceptual physics is an approach to physics teaching that stimulates students' higher level of cognitive skills and encourages them to see science everywhere and in everything they do (Hewith, 2009). The three-step learning cycle around which physics is developed builds students' understanding through exploration, develops comprehension through demonstration and thought provoking questions and culminating with students applying what they have learned through a variety of inquiry-based activities.

Further transformation was made in the curriculum. In the organization of the selected topics into teaching scheme, the contents were grouped into five sections with each section occurring or repeating itself every of the three-year programme in the senior secondary school. This implies that the scope and depth of the contents with reference to each section increased as the years progress. By this, students had opportunity to consolidate whatever was learnt in their previous year as new knowledge was built on the previous one. The contents were arranged in a logical, developmental and sequential order so that relationships

among the topics could be generated and assimilated. The concepts were classified as follows:

1. Concept of space, time and motion
2. Conservation principle
3. Waves
4. Fields
5. Quanta

The major concepts that underline and unify the topics in the curriculum contents are motion and energy yet the relevance of the topics to the society in terms of application is highlighted throughout the course. The approach was to teach the topics in a general form and elaborate them in applications using copious illustrations to aid understanding.

To this a specific teaching approach was advocated which is discovery methods of teaching. The method was aimed at ensuring that learning as an activity takes place (Adeyemo, 2010).

This method was typified with experimentation, questioning and discussion. In this the teacher is required to guide the students well to ensure learning takes place in the students, and lecture method avoided or eliminated to avoid the rigid one way in the classroom (Adeyemo, 2010).

In response to the on-going national and global reforms and transformations in the social and economic context the Nigerian Educational Research and Development Council (NERDC) developed a nine-year Basic Education Curriculum. It was planned that the first products of the new Basic Education Curriculum would proceed to the senior secondary schools in 2011. To further consolidate the gains of the new Basic Education programme as well as ensure the actualization of the governments seven-point agenda for national development (NERDC) developed a new curriculum structure for the senior secondary school in Nigeria which was approved by the National Council on Education (NCE) to take effect in 2011. Physics was one of the subjects for which the curricula was re-structured. The new curriculum which was to be operational in 2011 had the same objectives as the old one of 1984 which was in operation before 2011.

The structure of the new Physics curriculum changed from the conceptual approach to the thematic approach in which the former topics were changed to themes. The thematic approach, according to Daramola and Omosewo (2012) was to ensure compliance with national and global issues without necessarily overloading the contents. Again, the transformed curriculum changed from five (5) concepts to six (6) themes which have related topics and concepts. They are:

1. Interaction of matter, space and time
2. Conservation principles
3. Waves, Motion (without material transfer)
4. Fields at rest and in motion

5. Energy quantization and quality of matter
6. Physic in Technology

While additional topics and contents were added to the existing ones, a new theme known as physics in Technology was entirely added.

Just as in the former curriculum (1984), the spiral approach to contents was adopted in the curriculum as the guided discovery method of teaching was recommended to use mathematics to clarify the physics objectives. In the last transformed curriculum, ample opportunity for laboratory activities and discussions were provided. The programme was made to be student-activity oriented with emphasis on experimentation, questioning and discussions as well as problem-solving (Daramola and Omosewo, 2012). This was to stimulate creativity and develop process skills and correct attitudes in students.

The introduction of the theme; physics in technology, provided opportunity for the construction and operation of workable devices as well as acquaintance with some products of modern technology (NERDC, 2008). It will be worthy to note that the advantages of the transformed curriculum out-weighed the original physics curriculum.

### **Challenges towards Transformation of Physics Curriculum:**

The transformations of the physics curriculum did not go without expected challenges in the actual implementations. Such expected challenges as highlighted by scholars include; the use of scientific language and communication which are essential for the transmission of physics knowledge (Adeyemo, 2011).

According to Daramola and Omosewo (2012), and Adeyemo (2012), inadequate laboratory facilities and modern apparatus have posed some challenges in the implementation of the curriculum; and where they are available they are not functional or without functional laboratory. Physics teaching therefore would be ineffective because neither the teacher nor the students could acquire any knowledge for lack of instructional materials (Hewith, 2009). Hewith (2009) also opined that inadequate human resources which includes both teaching and non-teaching staff with lack of attractive salaries contributed greatly to the challenges of the implementation.

The challenges cannot go without the unavailability of qualified teachers in the new themes. Given, therefore the nature of physics and the paucity of teachers and equipment in schools, it is difficult to effectively implement the provisions of the secondary school physics curriculum (Adeyemo, 2010). Most physics teachers today were not trained in the new themes and as a result most of the themes are overloaded and left untreated.

### **Problem**

It is noteworthy that the transformations of the physics curriculum were very well planned in line with the global and societal needs so that students who offer the subject can live effectively in the modern age of science and technology.

It is also necessary that every student offering it be given opportunity to acquire some of the concepts, principles and skills but unfortunately the implementation of the transformed curriculum has been faced with challenges which affect both the performance of the students in external examinations and their been relevant in the society or science and technology. One therefore is moved to ask such questions as; Do inadequate provisions of material factors

impede the effective implementations of the curriculum? Do human inactions contribute to the challenges of effective implementation of the curriculum?

The solutions to these questions constitute the problem of the study.

### **Purpose**

This study aimed at

1. Ascertaining whether inadequate provision of some material factors/resources impede the effective implementation of the transformed physics curriculum.
2. Ascertaining if human actions contribute to the challenges of effective implementations of the curriculum.

### **Research Questions**

The following questions were addressed to guide the study.

1. To what extent do inadequate provisions of resource materials by the government or school or community challenge the effective implementation of the physics curriculum?
2. To what extent do human inactions contribute to the challenges of effective implementations of the physics curriculum?

### **Research Hypotheses**

To guide the study the following two hypotheses were formulated;

1. The mean responses on inadequate provisions of resource materials and human inactions do not differ significantly in the challenge to effective implementations of physics curriculum ( $P < 0.05$ ).
2. The mean rating responses on human inactions is not greater than the expected mean of 3.0 ( $P < 0.05$ ).

### **Methodology**

Both descriptive and inferential designs were adopted for the study aimed at determining the challenges towards transformation of secondary school physics curriculum in Nigeria. A scale for the Challenges Towards Transformation of Secondary School Physics Curriculum (SCTRASPC) consisting of two subscales of inadequate provisions of material resources and human inactions was used for the study.

All the three hundred and one (301) state government owned secondary school in Imo State, the physics teachers (whether qualified and non-qualified) and all the physics students in the state owned secondary schools constituted the target population for the study.

A total of six hundred (600) physics students and thirty-two (32) physics teachers were selected for the study. First a total of sixty (60) state owned secondary school of the 301 school (because state government owned secondary schools constituted about 98% of the schools in the state and 60 secondary school were about 20% of the schools in the state) were selected.

The selection was done by first clustering the schools into the three old education zones of the state from which twenty schools each from the three zones were selected and six (6) physics students each from each of the schools (3 each from SSI and SS2) and four (4) physics students each from SS3 were selected. The thirty-two (32) physics teachers were selected from the 60 schools and from among those who had. All selections were purposive.

The researcher designed and generated the instrument for the study which was validated by an expert in measurement and evaluation and two professional physics teachers and named a scale for the challenges Towards Transformation of Secondary School Physics Curriculum (SCTRASPC).

The scale was 5-item instrument with section A consisting 9 items for inadequate provisions of material resources completed by the teachers and Section B consisting of 6 items for human inactions completed by students. The reliability coefficient of the instrument was found to be 0.71 after a trial test of the instrument using 20 secondary schools with 100 physics students and 12 physics teachers from one zone.

The instrument was administered to the respondents using some research assistants who were educated and prepared for the duty.

The data collected were analyzed using mean rating and z-test statistic. While the mean rating responses were used to answer and analyze the research questions, the z-test statistic was used to test and analyze the research hypotheses.

## Results

**Research Question One:** To what extent do inadequate provisions of resource materials by the government/school/community challenge the effective implementation of the physics curriculum?

**Table 1:** Frequency responses of physics teachers on inadequate provisions of resource materials

E	ITEM	VGE	GE	ME	PE	VPE	Total Rep	$\sum fx$	$\bar{x}$
1	Lack of adequate modern lab equipment	20	9	3	-	-	32	145	4.53
2	Inadequate financial budget for sciences	29	3	-	-	-	32	157	4.91
3	Non-proper functional lab. facilities	23	8	1	-	-	32	150	4.69
4	No laboratory attendants	3	6	13	9	1	32	97	3.03
5	No incentives for physics teachers	5	8	13	2	4	32	104	3.25
6	Unsatisfactory teaching conditions	9	11	9	3	-	32	122	3.81
7	Textbooks not in context with new curriculum	8	7	10	3	-	32	104	3.03
8	Inadequate technological equipment	10	14	3	3	2	32	123	3.84
9	Inadequate no. of physics teachers	16	13	3	-	-	32	141	4.41
	Total						288	1143	3.94

Table 1 shows that all the resource materials to a great extent challenge the effective implementations of the physics curriculum except lack of laboratory attendants and textbooks

written with the context of the new curriculum. The table shows that the mean of means (3.94) is greater than the expected mean (3.00) an indication that inadequate provision of resource materials, by a great extent challenge effective implementation of the physics curriculum.

**Research Question Two:** To what extent do human inactions contribute to the challenges of effective implementations of the physics curriculum?

**Table2:** Frequency responses of physics students on human inactions in the implementations of physics curriculum.

S/N	Understanding of physics curriculum	VGE	GE	ME	PE	VPE	f	$\sum fx$	$\bar{x}$
1	Teachers' inability to entertain questions & discussion from students.	291	203	101	5	-	600	2580	4.30
2	No adequate practical tests/exams	123	289	167	1	20	600	2294	3.82
3	Skipping of some topics untaught	174	201	197	23	5	600	2316	3.86
4	Non relating lessons to real life situations/social values	116	226	101	123	34	600	2067	3.45
5	Inability to combine practical with theory	182	203	139	48	28	600	2263	3.77
6	Non supervision of teaching and learning by authorities	169	256	107	28	20	600	2266	3.78
	Total						3600	11786	22.98
	$\bar{x}$								3.83

Table 2 shows that all the factors/items to a great extent pose challenges to effective implementations of the physics curriculum.

Generally the result shows that the mean responses of the physics students (3.83) is greater than the expected mean (3.00), hence showing that human inactions to certain activities challenge the effective implementations of the physics curriculum.

**Research Hypothesis One:** The means responses on inadequate provisions of resource materials and human inactions do not differ significantly in the challenge to effective implementations of physics curriculum ( $P < 0.05$ ).

**Table 3:**

Z test analysis of responses of resource materials and human inactions in the challenge to effective implementation of physics curriculum.

Factor	N	$\bar{x}$	SD	Standard error	$Z_{cal}$	$Z_{tab}$	Decision
Provision of Resources	32	3.94	1.16	0.21	0.57	1.96	Accepted
Human inactions	600	3.82	1.05				

Table 3 Shows that  $Z_{cal} = 0.57$  and  $Z_{tab} = 1.96$

Since  $Z_{cal} < Z_{tab}$ ,  $H_0$  is accepted. It implies that the two factors are not significantly different in their challenge to effective implementations of the physics curriculum i.e both factors affect the implementations of the curriculum.

**Research Hypothesis Two:** The mean rating responses on human inactions is not greater than the expected mean of 3.0 ( $p < 0.05$ ).

**Table 4:** Z-test analysis of responses of physics students on human inactions in the challenge.

Factor	N	$\bar{x}$	SD	Standard error	$Z_{cal}$	$Z_{tab}$	Decision
Human inactions	600	3.82	1.05	0.04	20.5	1.96	Ho Rejected

Table 4 shows that  $Z_{cal} = 20.5$  and  $Z_{tab} = 1.96$

Since  $Z_{cal} > Z_{tab}$ ,  $H_0$  is rejected. This implies that the mean rated responses on human inactions is greater than the expected mean (3.00), an indication that human inactions is a challenge to effective implementations of physics curriculum to a greater extent.

### Discussions of Results/Findings

The results on table 1 showed that all the resource materials to a great extent challenge the effective implementations of the physics curriculum except the lack of laboratory attendants and books written in the context of the new curriculum which to a moderate extent challenge it. The mean rated responses of the physics teachers on the items (3.94) was greater than the expected mean, an indication that inadequate provision of resource materials pose a challenge to effective implementation of the curriculum.

On the other hand result of table 3 was in agreement with that of table 2. The results were in support of the assertion of Adeyemo (2010) who noted that curriculum transformation would consider the availability of teaching and learning resources and support facilities as laboratories and computer facilities. This according to Daramola and Omosewo (2012) is because ample opportunity for laboratory activities and discussions were provided which are student-activity oriented with emphasis on questioning and problem-solving. The participation of students in teaching and learning would help them a great deal even in life after school. This is as NERDC (2008) emphasized that the introduction of themes as physics in technology provides opportunity for construction and operation of workable devices for students.

On the other hand, tables 2 and 4 showed that human inactions pose a great challenge to effective implementations of the physics curriculum. While the mean responses of physics students (3.83) is greater than the expected mean (3.00) in table 2, the  $Z_{cal}$  is greater than  $Z_{tab}$  indication that it is a challenge to implementations of the curriculum to an extent. Table 2 showed that the physics teachers inability to interact with students and discussions with them to a very great extent, is a challenge to the implementation. The results support Adeyemo (2010) who advocated for discovery method of teaching physics to ensure that learning takes place in the students.

The results agreed with Daramola and Omosewo (2012) and Adeyemo (2010) who opined that inadequate laboratory facilities and modern apparatus pose some challenges in implementing the curriculum. They didn't fail to note that where the facilities are available such facilities are not functional. Results of tables and 2 and 3 collaborated with the findings



of Hewith (2009) that inadequate human resources like teaching and non-teaching staff with lack of attractive salaries pose challenges to the implementations.

### **Conclusion:**

Physics which is seen as a bedrock of scientific and technological development has some features believed to widen the knowledge of the learners if duly and critically followed and applied in any given situation and period. Such features include making the method of teaching physics a guided-discovery for learning efficiency and effectiveness; having a healthy and helpful interactions between the teacher and students to reduce difficulties when encountered and above all ensuring that lessons are made relevant to the societal norms and values

While these are being done the government and other schools' stakeholders should endeavour to encourage teachers and students in the effective implementations of the curriculum in the provision of necessary teaching and learning physics facilities.

### **Recommendations:**

In view of the findings and their implementations, the following recommendations were made.

1. Tertiary institutions should modify their physics education course contents for prospective physics teachers to incorporate the themes in line with the secondary school physics curriculum.
2. The Federal government should see for the training of prospective physics as an encouragement to have more teachers in the subject.
3. Authors should be encouraged to write physics books in line with current changes and in the context of the new curriculum.
4. Physics teachers should always be encouraged and sponsored for workshops, conferences and seminars in the area (field) to keep them abreast of any change in the curriculum.
5. The government should build and or renovate schools physics laboratories and make them functional.
6. Laboratory facilities and technological equipment should be provided to schools.

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