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ENRICHING PHYSICS EDUCATION IN NIGERIA TO COPE WITH THE CHALLENGES OF THE PRESENT MILLENNIUM

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Abstract

This paper aims at, firstly discussing on the practices of physics education to show the weaknesses that have militated against quality in the discipline over the years. Secondly, the writers desire to make some suggestions for enriching physics education for the present millennium. Among the areas of weakness are curriculum, teaching methods, quality of teachers, teaching materials, improvisation and resource utilisation in the classroom. Suggestions made for improvement include the extension of teacher training period, review of the senior Secondary School physics curriculum, one year internship as well as Government sponsorship. Implication for the physics teacher are also highlighted.

Introduction and Background

Physics Education can be referred to as education in physics, According to the Oxford Advanced Learners Dictionary of international (new) students edition, 1997 p.269.

Education is the process of training and instruction especially of children and young people in schools, college etc., which is designed to give knowledge and develop skills.

It further explains that education is the field of study dealing with how to teach somebody about something or to do something.

Thus, education is a process in which both awareness and challenges are brought to bear in the lives of the people. An educated man is first and foremost aware of what is happening, aware of the cultural, moral, scientific and economic values and mechanism of social and scientific operations (Abdullahi, 1976). It is from such knowledge that challenges are posed for improvement.

For instance, education that is meant to produce a teacher (Teacher Education) is to expose the teacher to the knowledge of subject matter, learners behaviour pattern, societal values, socio-cultural background of the learners as well as appropriate teaching/learning strategies. (Ikwa, 1997). It is after such awareness has been given that one receives the challenges to better the lots of what he/she is involved in.

Physics Education as contained in the core curriculum for senior secondary schools (physics) has to do with creating awareness with respect to physics while (Abbott, 1997) specify that it is for creating awareness with respect to physical principles and laws governing the universe-active and inactive as well as the relationship between energy and matter. In the process, three categories of people involved in physics education are physicists, physics teachers and physics educators.

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The difference among the three categories is that while the first takes on the challenges of finding out more facts and discoveries about the World of physics, the second is concerned with ways and means of transmitting this knowledge to the citizenry and to make them literate with respect to awareness of facts, laws and principles of physics which are phenomenal in nature. The last group is research-oriented, whose focus is in ways and manners of facilitating teaching and learning outcomes.

The study of physics has been and will continue to be of tremendous importance to humanity for its ability to explain natural phenomena and every day occurrences as well as its central role in the world's current technological development (Ikwa, 1997 and Ikwa, 2000). Notable areas among others, are in transportation, aviation, medicine, health, human leisure or comfort, agriculture, industry, warfare, peace, information (data) processing and communications (STAN 1994, Ogunleye, 1996). Within the past two decades, each of these areas has witnessed rapid advances and innovations particularly within this global era of computer technology. These pose a lot of challenges for all three categories of persons involved in physics education, physics curriculum development, resource utilisation, improvisation, appropriate teaching strategies and the inculcation of positive attitude on learners or students of physics.

This paper therefore focuses on how to enrich physics education in Nigeria so as to face squarely and cope adequately with the challenges of the present millennium.

The Problem

A physics educator is one who goes beyond physics teaching to researching with possible areas of facilitating instruction in physics (Ogunniyi, 1985 and Ivowi 1997 a). The research areas include physics curriculum itself-its development and evaluation. So, while the physics teacher implements the physics curriculum, the physics educator, besides development the curriculum, evaluates it. These three groups involved in physics education have common problems. These are insufficient infrastructural and teaching facilities; insufficient manpower; cultural inhibitions; laise fare attitudes of both teachers and learners; poor enrolment of students; low participation of females and wrong perception or misconceptions of physics by students (Iwovi, 1999, Onwioduokit, 1999).

These and more problems have persisted and hindered progress in the field of physics education in the 20th Century in Nigeria. For instance the observed increasingly low performances of students in public examinations, like West African Senior Schools Certificate examination and low enrolment (Jegade, Ofuka and Eniayeju, Eds, 1992, Adeyegbe, 1993 and WAEC, 1994-1998), points to the fact. Other reasons for the observed trend are overloaded curriculum and poor understanding of concepts involved due to their "Difficult" nature (NERDC, 1993, Onwioduokit, 1996 and Ivowi, 1997a).

In other to reverse this unfortunate situation or trend in keeping with the needs of this millennium, there is an obvious need to adopt a meaningful, purposeful, dynamic and deliberate strategies and innovations in physics education. Hence the emergence of this paper on enriching physics education to cope with the challenges of the present millennium.

The Approach

The approach of the present write-up is two folds. First to discuss the areas of weakness in the practice of physics education up to the 20th century. Secondly, to mention areas that should be improved upon to have an enriched physics education programme in this millennium. Such areas include physics curriculum, teaching materials, teaching methods, quality of teachers, improvisation, resource utilisation in the classroom and implications for the teacher.

Areas of weaknesses in the Present Education Programme.

The practice of physics education as a field of study presently has much to be desired. A careful analysis and appraisal of various units constituting the field shows some fundamental weaknesses of the programme. Some of these are as briefly discussed below:

- (a) **Physics and Physics Education Curriculum:-**
The situation with physics curriculum in schools presently is not significantly different from what it was when Alonge (1982) made the following remarks:

the content of science taught seems void of local environment; the successful products of science education or education in sciencedo not generally identify with the technological needs of the society; The pride of science as an enjoyable creative and humanising enterprise laden with discoveries and things yet to be discovered seems dented as the curriculum cannot bring this to bear.

Nine years after this remarks, African Development Bank Groups (1991), carried out a study with findings on the curriculum expressed as follows:

One of the most important and lasting effects of the colonial condition on African education has been on the nature and content of the instruction process, where the needs and values of the colonial power provided for a long time the guiding orientation. On the whole, and notable exceptions notwithstanding, curriculum and instruction in Africa's school still reflect a good deal of this colonial orientation, and it is only recently that major efforts in such areas as curriculum reform has been initiated.

It is sad to note that even with the recent emphasis, seminars, conferences and workshops on physics curriculum, the curriculum has still, to a large extent, not reflected the values and materials of the immediate environment. The emphasis on knowledge of the strength of materials, for an example, stops at the strength of different wires. No attempt is made to know, on a quantitative scale, the strength of Local materials used as ropes or for other purposes (Onwioduokit, 1998).

The curriculum does not adequately reflect the cultural values and beliefs. The immediate environment is not fully integrated. The result of such negligence implies a lack of focus on environmental (rural) transformation which is expected to hinge on local technology. The emphasis is so much on the transfer of technology because the curriculum is still, to a large extent foreign. Practical work is still to a large extent expository with little or no room for reasoning and the development of creativity.

(b) Teaching Materials

A Visit to most school's physics laboratory in the country could be very disappointing. The poor state of the laboratory with respect to the items and their quantity available vis-a-vis the curriculum requirement and the number of students in the course, is deplorable. This condition has persisted in most schools for years without any improvement. This is why most students are not adequately exposed to practical works before the examination period. Some are either exposed to practical works with borrowed apparatuses one or two weeks before the external examination are exposed at all.

No budgetary provision (separate) is made for science education, generally, prepared and approved by the Ministry of Education (Yoloye, 1984; and Ebhohimen, 1985). Besides inadequate teaching/learning materials, most recommended materials are still foreign. Local Materials are hardly utilised. There is a case of a teacher who could not carry out a simple pendulum experiment with his students with the excuse that there were no pendulum bobs.

Over the years there has been deliberate attempt to fully involved local materials in the environment for teaching physics. Most physics materials are all prototypes and aliens to the Nigerian local environment. African Development Bank Group (1991) research also showed this:

Teaching materials have reflected a similar pattern as the curriculum and are still far from responding adequately to policy makers across the continent, especially as the objective of a stronger and more knowledgeable sense of cultural Africa's development philosophy.

This problem lingered all through 20th century and has hindered the learners' knowledge of integration of science with the local environment.

(c) Teaching Methods

Physics educators have carried out research works on teaching methods and strategies and there has been a consensus that an enquiry approach is preferable. (Olarinoye, 1989) This approach requires the teacher to lead the learner to discover for himself the facts, knowledge, and principles to be learnt. The emphasis has since moved from "telling" to "guiding". This is very taxing on the parts of both the teacher and the learners. It is pivoted on "doing" and this requires various materials and equipment.

It is, perhaps, because of the demands of enquiry that most teachers still teach physics in such a way that encourages rote learning and memorization of facts and concepts. This type of instruction, in part, reflect limitations in teachers' training as well as the over-emphasis in certification based on examinations. The current ways and manner of teaching which aim at knowledge (of physics) required for passing SS Certificate Examination is not likely to lead to achieving goals expressed by several Nigerian educators (Aderinlowo 1970; Fafunwa, 1974; and Banu, 1985). The current practice more or less gears toward preparing students of high intellectual ability for science and science related professions without considering the cultural interaction between science and the society.

(d) Quality of Teachers

The quality of any educational programme is not only determined by the quality of its teachers but is also limited by it. Presently, in our Universities physics teachers to be are trained for 2,3 or 4 years depending on the entry qualification. To be admitted into a B.Sc (Ed) degree programme in physics, the candidate is required to have a credit in physics and mathematics besides meeting other basic University requirements for admission.

In some Universities, the remedial science programmes have been mounted from where students are admitted to read pure science disciplines or disciplines in science education. It is worth noting that but for the remedial science programme, most Universities would hardly have candidates for physics education (Onwioduokit, 1996 a).

Semester results in most Universities have shown that the performances of physics education students do not differ significantly from their pure physics counterparts. In spite of this, experience during teaching practice supervision has shown a lack of proper grasp of the school physics curriculum they are meant to teach. Student teachers do not really understand the concepts involved in the school physics curriculum. This may be due to lots of factors including, perhaps that they were not properly taught the curriculum. There is this information from a friend in the Ministry of Education. A certain candidate with B.Sc (Ed) degree in physics with second class upper division from a certain very prominent University was interviewed for a teaching job. The question came: What is a simple harmonic motion? To the amazement of everyone on the panel, the student answered impudently, no idea!

The quality of physics teachers in schools presently cannot match with the national expectations for the present millennium, something has to be done urgently.

Improvisation

Improvisation is one of the very important aspects of teaching physics. It poses a lot of challenges to the teacher as he needs to acquire the skills of creativity, Originality, imaginative thinking, resourcefulness, fabrication or modelling and manipulative skills. Eshiet (1996 p 20) defined improvisation as

The sourcing, selection and deployment of relevant instructional elements of the teaching/ learning process in the absence or shortage of standard or accredited teaching/learning elements for a meaningful realisation of specified educational goals and objectives.

Thus, by the above definition only three elements of the teaching learning process namely, curriculum, teacher and materials/facilities, can be improvised. The student is not improvisable. The teacher receives, modifies, Transmits and evaluates the curriculum. He is also expected to improvise teaching materials that are not available.

Unfortunately a lot of problems have characterised improvisation process in our schools. These range from lack of training on improvisation, lack of funds, negative attitudes exhibited towards improvisation by teachers to inadequate support by Government (Eshiet, 1987). As a result the tempo

and investment in the practice of improvisation has been found to be relatively low (Nwaizugbe, 1991).

Resource Utilisation in the classroom

It is a known fact that a conducive environment promotes effective teaching and learning. One of such environments is the classroom. Given that appropriate and sufficient alternative materials have been improvised, the teacher requires effective resource utilisation techniques in order to be able to succinctly and clearly explain himself/herself when using such materials.

A trip to most schools' classrooms reflect almost a non-existent use of resource materials. Sometimes the reason is that teachers find it difficult to understand the working principles of resource materials. Hence this paper advocates for thorough understanding, good articulation and appropriate procedure on proper utilisation of available materials

Enriching the quality of physics Education for the present millennium

The aforementioned review of the quality of physics education using various indices has shown that the curriculum, teaching methods, quality of teacher, among others, need much to be desired.

Specific and deliberate attempts should be made to improve upon the quality of physics education desirable for the present millennium.

(a) Physics Curriculum

The following modifications are suggested:

- (i) Inclusion of some local materials and objects for study, for example, investigating into the physics of local materials;
- (ii) Application of the knowledge of physics to explain local phenomena;
- (iii) the use of local materials in teaching physics concepts.
- (iv) Incorporation of the difficult concepts found in school physics curriculum into the undergraduate curriculum especially under special method courses. This should be taught by a physics education lecturer in the Department of Science Education. A list of such physics concepts has been compiled by Onwioduokit (1996 b).

Quality of Teacher

The quality of physics teachers can be improved through:

- (i) regular in-service training programme;
- (ii) introduction of one year internship (practical teaching) programme under very close supervision and tutorship of both the course lecturers and the professional teachers in the schools involved. It is recommended that a special monthly allowance be given to practising students within the one year (preferably the penultimate year.)
- (iii) The 2-year degree programme be abolished. The minimum years spent for a degree in physics education should therefore be four years (for NCE holders), including the one-year internship. For non NCE graduates, the period will be six (6) year: 4 years of study in pure physics. 1 year studies in education and 1 year of internship.
- (iv) The special method courses should be offered yearly from years 2 to 4, during which micro-teaching should be practised in earnest.
- (v) Drop-outs from Faculty of pure and natural Science or any other Faculty should no longer be admitted into physics education programme.
- (vi) Science Education students, especially in physics, where there has been consistently very poor enrolment, should be offered sponsorship by government. It is a fact that appropriate motivation can both enhance enrolment and quality.

Teaching Method

To be able to expose physics teachers in training to a variety of modern teaching methods and techniques, the trainers, that is physics educators, would have to be themselves exposed to the methods and techniques. This implies that means of acquiring recent local and foreign journal and books should be provided for. Sponsorship of physics educator to conferences, seminars and workshops cannot be overstressed.

The following teaching methods should be promoted to enhance the quality of physics education for the millennium

- 1 A fresh emphasis and full implementation of inquiring approach;
- 2 project method;
- 3 Computer-assisted technique; and
- 4 mastery learning technique.

In teaching, it would be beneficial to de-emphasize examination and certification. Emphasis should shift from these to the understanding and application of the concepts taught. Oral examination should be encouraged to augment the written forms.

For instance, no employment of physics teachers should be made without a well planned interview that should incorporate the rest of the knowledge of subject matter as well as the ways of disseminating the knowledge. Appointment based on more scrutiny of certificates should be discontinued if quality is anticipated in the present millennium.

Improvisation

In order to meet the challenges of improvisation in this millennium, concerted efforts must be made to reduce problems associated with it, adoption of a total re-orientation of attitudes and values in favour of it, purposeful and deliberate attempt at actual practice of improvisation is advocated. Perhaps what we need now is to identify and make a list of simple materials shortages and substitutes from our local environment.

Implications for the Teacher

The implications for the physics teacher on enriching physics Education in Nigeria to cope with the challenges of the present millennium is enormous and inexhaustive. But briefly and in the context of this paper the average physics teacher

- 1 needs a good curriculum planning and designing approach.
- 2 should know and adopt appropriate teaching strategies in the process of transmitting the entire physics curriculum.
- 3 should adopt effective procedure for choosing relevant resource materials during teaching.
- 4 should undergo 4 years for (NCE holders) and 6 years for non NCE holders for first degree programme to promote professionalism in teaching.
- 5 should demonstrate a clear understanding, articulation and appropriate procedure for proper utilisation of available materials.
- 6 should be ready to change his/her attitude to favour the practice of improvising physics materials.

Conclusion

The paper, having considered some loopholes in the practice of the physics education in the 20th century, made attempts to see how the faults could be overcome so as to enrich physics education in the present millennium. It should be noted that the modifications and changes suggested are very demanding on the part of government. This is considered worthwhile because government should go in for nothing less than quality through enriching physics education. If our educational system is allowed the way it is, there may be a total and irretrievable collapse not many years hence. This advented enrichment of physics education in Nigeria will place us in a better position to cope with this present age where science and technology are the other of the day.

Arising from the above considerations, it is obvious that the current senior Secondary school physics curriculum needs to be reviewed especial after 16 years of its use, Arising from the entire considerations in this paper, our physics education programme needs to be enriched. The most appropriate time to prepare for the future is now.

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