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THE CONTRIBUTION OF SCIENCE EDUCATION TO NATIONAL DEVELOPMENT

Ngozi H. Arihilam

ABSTRACT

No doubt science education has contributed to nation building. The inadequacies bequeathed to the nation in the manner of teaching science education from her colonial past has been traced to the fact that countries like Nigeria did not emphasize science education from independence. This necessitated the need to reconstruct the science and indeed biology curriculum to reflect and include the indigenous traditional and social live experiences of the people. This paper outlines the contribution of science education to national development and concludes that the continuous social and economic growth of the nation is partly dependent on the essential emphasis placed on science education. This includes encouraging the interest of home-made professionals who are in touch with the philosophical realities of the people to genuinely engage in science education.

Keywords: Curriculum reconstruction, Education innovation, National development, Scientific activities, Science infrastructure

Introduction

Modern teaching of science in Nigeria, according to Godek (2004), began when western education was introduced into the country in the last half of the 19th century. The instruction consisted of nature study, hygiene and agricultural science in the primary schools and physics, chemistry, biology, general science, health and agricultural science in the few secondary schools available then. Before this time, these science subjects were taught almost like a religious dogma that cannot be challenged. To a large extent, this wrong approach of delivering science education was common in developing countries and hampered the early assimilation and appreciation of science subjects generally (Godek, 2004). Only the children of the elite went to secondary schools because of limited resources. It was even accepted then that only a few students have the unique ability to learn and benefit from science. Syllabi and curricula were borrowed without local input from developing societies (Black & Harrison, 1995).

With independence in the 1960s, it was apparent to the administrators that the type of science education bequeathed to the society was not to take the nation to the required level. This was because there existed a yawning gap between the needs of the society and the level of science and technological manpower available to meet those needs. It then became evident that the nation needed to develop a sound science education programme.

At about this time, and of course, with the help of the developed economies, some national curriculum centres were established to build, equip and train staff for curriculum development. Also, at about this time, the African Primary Science Programme (APSP), the African Association for the Advancement of Science and technology, the West African Association of Science Teachers were formed. All together, they were networked with the International Council of Association of Science Education (ICASE) (Godek, 2004).

The aftermath of these were noticeable changes in all fronts. Textbooks, workbooks and teachers' guides were re-written. The

changes affected in-service teachers training and the assessment method in public examinations. However, some expatriate staff (from developed countries) who supervised the changes were found to have imposed not only their professional knowledge but also their cultures, (Ogunniyi, 1985).

In late 1970s, it became evident that the nation needed to indigenize her curriculum materials and bring in some traditional and local contents. At about this time also female participation became an important issue in science education. The goal was to have enough trained personnel to reduce the dependence on imported expertise and shift training away from an academic orientation to scientific literacy.

As observed by Lewin (1992), UNESCO and other aid agencies came to the aid of Nigeria and other needy developing countries with some financial assistance, laboratory equipment, textbooks, films, slides, teachers and training of curriculum specialists. This resulted in the creation of Universal Primary Education (UPE) which transformed into Universal Basic Education (UBE) that had tremendously encouraged the teaching of scientific skilled workforce and provided some scholarship to science teachers. Following this transformation from the 1970s, the opportunity to study science has increased from the primary to the university level in Nigeria (Ogunniyi, 1986).

Unfortunately, due to the ever-increasing changes in technology that has followed the trend in the delivery of science education, the much-expected transformation has not happened 100%. This paper has attempted to describe science education from the point of core science subjects and examine how science has contributed to national development. The paper has also discussed the challenges facing science education considering what things can be done in a different way and recommended some possible ways out.

What Science Education is

From the universality of the word science as a branch of knowledge that examines the structure and behaviour of the physical and natural world through experiments and observation, science education is most commonly broken down into the following fields Biology, Chemistry and Physics David D Thornburg (2009). The purpose behind any scientific activity is to give an explanation for something; to provide an accurate description of some events; to diagnose the nature of some conditions. For instance, it is the purpose of science education to explain why the air we breathe helps food metabolism and release of energy.

Today the most significant difference between the developing and developed countries of the world is the difference in the level of science and technology in the two groups. Hence, it is of importance to recognize the need for a good education system (Arthur & Sheffrin, 2003). Since the return of democracy in 1999 and a relative increase in funding of education in Nigeria, the number of students taking science courses are on the increase because of the government's affirmation action to fund subjects which are crucial to science and technology development, although the percentage is still below the recommended 40%. However, low literacy rate, poverty, poor nutrition, inadequate investments in both human and capital development remain the factors, among others, that militate against the development of science education in developing countries including Nigeria (Ndubueze, 2011).

It must be agreed that even the so-called advanced countries passed through these developmental stages, but with enough commitment though, they were able to emerge with enough creative scientific and engineering skills today. As we live, science

and technology is rapidly growing and requires the fundamental development of science education if the nation must join her ranks in the world.

How Science Education has contributed to National Development

The use of science through technology has created the need to pursue science education all over the world. Without scientific discoveries, it would obviously be hard to differentiate between our world of today and that of three centuries ago. According to Nwabueze (2011) science education has had massive impact in our national development.

Some of the most substantial impacts are in the area of communication, especially through the use of internet and mobile devices. Information technology now affects the way business is conducted between people, organisations and nations. The use of software and hardware technologies now facilitates teaching and learning process. Advancement in science is active in games, movies, animations, sports, social networking and in the entertainment industry as a whole, (Shrestha & Maharjan, 2018).

On how businesses are being conducted, the use of networking, video and web conferencing have enhanced how transactions are done online and given organisations the opportunity to reach out to employees and clients anytime anywhere. This has enabled companies reduce cost and the inconvenience of travelling to engage in business talks outside their domain.

In the manufacturing industry, modern science has created machinery that makes the creation of tangible physical products possible for business. Operations have been made simpler and reduced to the use of robots, machines and assembly lines, leading to increased productivity.

Modern science and technology has made manufacturers reduce their carbon footprint (i.e. the amount of CO_2 emission into the atmosphere) and become green because production process can now be controlled using computer (Rajagopalan & Rajan, 1987).

In agriculture, science education has led to the creation of new crop varieties and advances in new crop management technology have also been reported, e.g. in Umudike, Nigeria (FMANR 1988). With the use of renewable energy, food processing, management and storage are now being carried out right on the farms and delivered fresh to the consumer.

Challenges facing Science Education in National Development

The factors affecting science education in Nigeria are varied and complex, ranging from poor policy formulation to implementation; to the quality of personnel involved in executing the half hazard policies; to inadequate science infrastructure.

a) Inadequate Science Infrastructure

One critical area that has affected the development of science education is the neglect of proper investment in human and infrastructure section. However, there has been more pressure to increase spending in this area since the return to democracy in Nigeria. Spending in this area included provision of relevant textbooks, equipment, consumables (models, charts, reagents) and physical learning environments which includes adequate science classrooms and laboratories. It also includes strong motivation of the teaching staff. Figure 1 below depicts World Bank plot of spending in science education among developing countries obtained through the UBE Programme, FAO, 2003. The figure also shows Nigeria's poor performance in science education infrastructure generally before the coming of democracy when compared with developing countries like India and South Africa. No wonder the inference that the worst democratic government is better than any dictatorial dispensation.

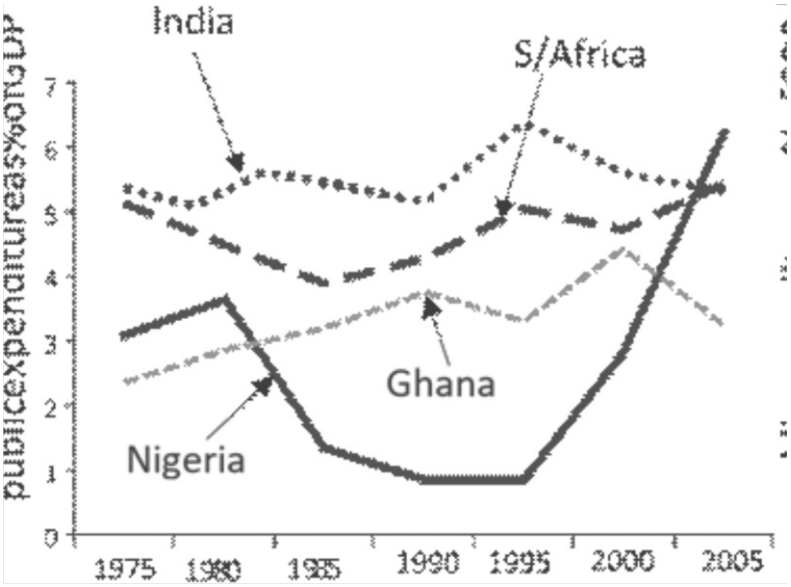

Fig 1 GDP spending in science education in India, S/Africa, Ghana and Nigeria (World bank)

b) Teacher Quality

Closely related to the inadequate scientific infrastructure is the lack of access to highly qualified science teachers. It is said that the only way to predict the performance of students in a class is by the quality of the students' teachers. The need then arises to encourage teachers to work in the core science area to cut across all those interested in a future in education (David, 2009). Again, this inadequacy has even affected enrolment and performance of students in the critical science areas as shown in table 1 below.

Table 1. Enrolment and performance of student in biology, chemistry and physics in WAEC from 2005-2009

YEAR	BIOLOGY		CHEMISTRY		PHYSICS	
	Total entry	Pass grade at A-C	Total entry	Pass grade at A-C	Total entry	Pass grade at A-C
2005	1,051,557	3574	349,936	5094	344,411	4156
2006	1, 082,556	3561	352,452	5095	345,225	4384
2007	1,072,602	3357	432,230	4596	427,398	5805
2008	1,285,048	3394	428,513	4444	424,893	4826
2009	1,903,552	3387	442,091	4597	429,174	4356

Source WAEC Yaba, Nigeria

It can be seen from the table that the number of students that passed with the requisite grades (A-C) in the core science subjects is abysmally poor when compared with the actual number of enrolments. From the analysis in Figure 2, the worst performance can be observed in biology as a subject within the period under review with a percentage performance of 0.33%. Both chemistry and physics had poor performances of 1.45% and 1.35%, respectively.

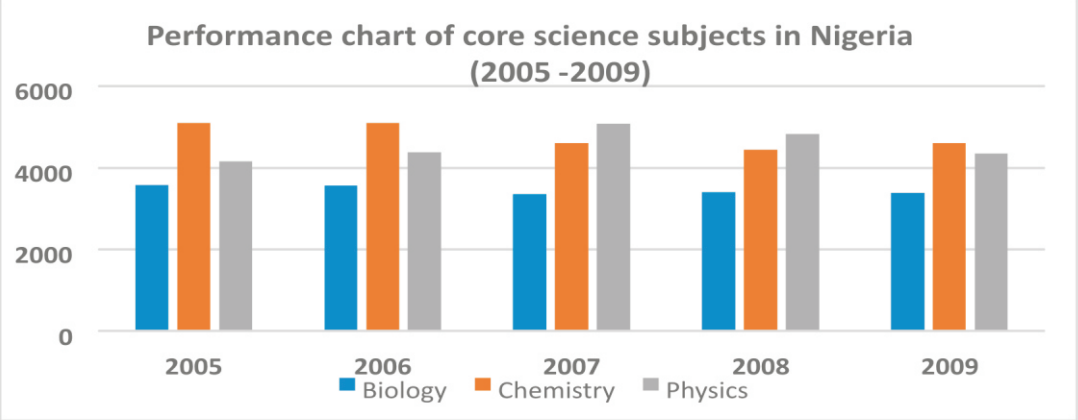

Fig 2. Performance chart of core science subjects WAEC, (2005-2009)

c) Lack of Adequate Practical Exposure

The importance of hands-on science education (practicals) cannot be over-emphasised. Performance of practicals (experiments) enable students to observe non-intuitive phenomena and puts the student in a better position to reconcile the underlying theoretical knowledge. In this setting, a well-equipped laboratory can take advantage of the necessary hardware to capture experimental data which can then be transferred to computer for further analysis.

d) Curriculum Deficiencies

Nigeria continues to face many science education problems. Financial crises, political instability, disintegration of civil order have obstructed progress in education innovation and excellence. Since 1992, states have been responsible for secondary schools except for few unity schools dotted over the land. Current policy calls for nine years basic education for all junior secondary school. The criticism against the current curriculum is that it does not reflect the language and culture as a medium of instruction of the people, thereby making irrelevant the technological needs of the people. Generally, the present curriculum is unrelated to the conditions and demands of life in rural areas. Again, the curriculum as it is presently is devoid of the fundamental reality of the knowledge of people's existence. For example, the clash between Islamic tradition and western education demonstrates that schooling (science education) is viewed as a form of foreign corruption which must be resisted hence, the genesis of Boko Haram in Nigeria.

Benefits of doing things differently

In Nigeria and most developing countries, the quality of science education is influenced by economic, socio-cultural, political and administrative factors. For a more realistic planning, government, individuals and the private sector should collaborate to invest more in science education. The collaboration should include industries that should be able

to cross-pollinate technological advances to potential researchers and users.

Funding in the area of science education should be increased and effective supervision put in place to monitor the stages from disbursement to proper utilisation. Regular renewal and design of science curriculum should be ensured to make science education more practical and market-oriented with a view to producing highly skilled and highly educated graduates for both the private sector and the traditional civil service.

Conclusion

For the quality of science education to improve in Nigeria, appropriate policies and homemade professionals who are in tune with the philosophical orientation and realities of the people of Nigeria must be incorporated in science education in the language of the people. This is the practice in countries like India, where teaching is done in the style of the people and textbooks, and software programs have been written in the peoples' language. This practice over the years has brought India ranking very high among IT nations of the world. Nigeria can replicate this practice, and the economy will ultimately be better for it.

Recommendation

The following points are recommended for science education to make meaningful contribution to national development:

1. Funding for science education and indeed technology should be stepped up by the authorities concerned.

2. The government should consider extensive training and re-training of science teachers, especially at the rural areas through in-service training, workshops, conferences and seminars.

3. In partnership with the private sector, government should improve the science infrastructure in our schools. This should include buildings, laboratories, libraries and provide current science equipment for modern day experiments and practicals.

4. Policies on science education and curriculum formulation should be done in collaboration with the industry. This has the advantage of taking into consideration state of the art culture especially in the core science fields.

5. There should be a strong political will by the government to implement policies on science education to the letter.

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