

THE ROLE OF BIOLOGY IN SUSTAINABLE DEVELOPMENT.

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Abstract

This paper focused on pinpointing how the study of biology could promote sustainable national development in Nigeria. It stressed that the study of biology has the capacity to, among other things: generate a variety of jobs; improve community and personal health practices as well as the management of refuse and household waste. It can reduce ecological problems, promote good nutritional practices and conservation of Nigeria's natural resources. It was suggested that the problems militating against the effectiveness of the study of biology, which include: emphasis on passing examinations, shortage of experienced and dedicated manpower, the poor state of teacher training institutions, outdated teaching methods, lack of well-equipped laboratories and poor funding, be addressed for sustainable development in Nigeria.

Keywords: Biology, Sustainable Development, Nigeria.

Introduction

Biology is a branch of science that deals with living organisms and their vital processes (Joshi et al 2023). It is also defined as the science of life or living matter in all its forms and phenomena, especially with reference to origin, growth, reproduction, structure and behavior or the study of living organisms, divided into many specialised fields that cover their morphology, physiology, anatomy, behaviour, origin, and distribution (Oxford Languages, 2023). Charles Darwin, William Harvey, Louis Pasteur, Gregor Mendel, Alexander Fleming, and Anthony Von Leeuwenhoek were all pioneers of biology in their various fields (Roberts, 2005). Today biology has grown from the familiar areas of microbiology, biochemistry, zoology, genetics, and botany to new specializations that include neurology, endocrinology, limnology, electrophysiology, and biotechnology. (Jegede, 1989; Roberts, 2005; Idodo-Umeh, 2010). According to Ahmad et al (2018), 'It is the basis for the survival of mankind because there is no area of human existence that does not encompass the usage of Biology. Application of Biology can be found in the areas such as Bio-fermentation, Biofuels, Bioinformatics, Bioremediation and many more.'

Educating people in biology has been widely acknowledged as a way of promoting sustainable economic development, eliminating poverty and introducing social welfare. (Nwagbo, 2005). Biology has contributed positively towards national development in Nigeria numerous ways including promoting good health practices, solving the problem of food scarcity, hygiene, family life, management and conservation of natural resources, biotechnology, and ethics. (Akpeli, 2019) The study of Biology is important to a growing economy like Nigeria (Aina, 2013).

Objectives of Biology education

The objectives of biology in the National Policy on Education (FME, 2013) include:

Acquisition of adequate laboratory and field skills in biology.

Acquisition of meaningful and relevant knowledge in biology.

The ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture.

Developing reasonable and functional scientific attitude.

Biology and sustainable development.

The knowledge of biology and biology education are central to achieving sustainable development in Nigeria (Ahmad, et al 2018). Biology and its associated bio-based technologies have been reported to have a significant impact on sustainable development and should play the following roles in Nigeria:

1. **Employment.** Biology has some entrepreneurial related skills that graduates could use as a source of livelihood; a means of generating employment and a way to poverty eradication without necessarily depending on government jobs (Bello et al 2020). Ojone (2017) reported that the knowledge and skills acquired through biology can be used to eradicate hunger and extreme poverty since it has the tendency of creating jobs and improving food production. According to Bello et al (2020); creating and selling biology resources online is an avenue to make money that is yet to be fully explored by many Nigerian graduates in the field of biology. They can successfully participate in Biology-related online businesses by providing digitalized biology resources such as Biology Blogging, Bio-edutainment, Selling Online Biology courses. Biology Podcast, Creating and Selling Biology e-books and selling digital Biology Photos among others. Other job opportunities provided by the practical application of the study of biology that will enhance sustainable development in Nigeria include: Aquaculture, including fish-farming, shrimp and crab farming; Agro-consultancy services; Bee-keeping; Breeding Edible Insects - including crickets, wood cockroaches, winged termites, scorpions, mealworms and silkworms (Bradley, 2014); Biodiesel Production (Romano & Sorichetti, 2011). Composite Fertilizer Production that is biodegradable and environmentally friendly; Ecotourism; Floriculture; this is the cultivation flowers or flowering plants for ornamental purposes, usually for export as well as for domestic markets; Horticulture (the growing fruits and vegetables); Mushroom Culture; Biological Pest Control; Poultry farming (Edom, 2016); Preservation of Soil Fertility; Rabbitry (Abimbola, 2017); Sericulture (Production of silk); Soil Improvement: Waste to Wealth and Snail Farming which is a lucrative business venture and one of the most profitable farming businesses in Nigeria at the moment (Akintomide, 2020) etc.
2. **Community and personal health practices:** One major objective of biology education is to promote good community and personal health practices. Students are taught the causes, modes of transmission, symptoms, and methods to control various diseases. Waterborne diseases such as cholera, dysentery, and poliomyelitis and airborne diseases such as tuberculosis, whooping cough, and measles (Nwido and Okoruje, 2008; Obi, 2011; Ahmad et al 2018).

The effectiveness of personal hygiene and a clean environment in preventing these diseases is stressed by biology. The control of malaria, a major killer disease of children under 5 years, has posed a major challenge to the government and health workers. Students acquire the knowledge of how to control the breeding of mosquitoes, which are vectors of malaria parasites (Idodo-Umeh, 2005).

The ravaging effect of sexually transmitted diseases (STDs), including acquired immune deficiency syndrome (AIDS), can be reduced through sex education and good health practices (Idodo-Umeh, 2005). The study of Biology can therefore reduce the man-hours lost due to ill health and the cost of maintaining various health institutions thus promoting sustainable development in Nigeria.

3. **Management of refuse and household waste:** Simple waste management principles acquired from the study of biology can provide the knowledge required to deal with the problems of waste disposal and save the nation from the attendant effects of poor waste management and the heavy cost of machinery which are difficult to maintain and frequently breakdown (Miller, 2000).
4. **Reduction of ecological problems:** Many ecological problems such as desertification, erosion, and flooding, which are common in our communities today, are made worse by human activities that include deforestation, and blocking of natural waterways and canals by property developers and refuse (Akpeli, 2019). The study of biology can provide the knowledge required to combat desert encroachment and gully erosion through the proper management of vegetation and refuse disposal. Current global challenges such as global warming, pollution, and ozone layer depletion and their solutions are some of the issues covered by biology education (Madar, 2001).
5. **Promotion of good nutritional practices:** Biology education explains the nutritional value of most food items consumed in Nigeria. The requirements of the human body for various food types such as carbohydrates, proteins, fats and oils, vitamins, mineral salts, and water are stressed, and the need for a balanced diet, which is a diet that contains the right proportion of all the food types needed by the body. This knowledge will prevent many food deficiency diseases, such as kwashiorkor in children, scurvy, beriberi, and goitre which are brought about by poor eating habits. The health implications of obesity are also explained (Idodo-Umeh, 2005). The objective of eating right is to ensure the availability of a healthy population that will contribute to national development and transformation.
6. **Conservation of Nigeria's natural resources:** The study of biology inculcates in students the need for controlled exploitation and wise use of the nation's natural resources such as minerals, plants, animals, land, and water. This is because these resources cannot be produced or replaced by man even though they have become intricately tied to human survival and health (Roberts, 2005).
7. **Overcoming misconceptions and myths:** Several myths and misconceptions in the past led to evil practices such as the killing of twins, the dedication of albinos to gods, and the belief in "Ogbanje spirits"(Ahmad et al 2018). Studying biology has enabled the modern society to understand these phenomena and enhance development.

8. **Reducing the incidence of hereditary defects:** In genetics, biology has shed more light on a number of issues bordering on human heredity. The findings now form the basis for genetic counselling. For instance, biology discourages marriage between people with inherited defects such as sickle cell anaemia (Chukwuneke, 2010).
9. **Genetically improved varieties of plants and animals** have contributed immensely to boost of the abundance of food in the nation.
10. **Control of pests and parasites:** Through the study of entomology, parasitology and related fields in biology, pests and parasites detrimental to the health of human beings, plants and animals are monitored and brought under control.
11. **Promotion of family planning:** Overpopulation is a major problem in developing countries. This is contributing to food shortages, unemployment, urban congestion, and the creation of slums. The provision of housing, schools, and health facilities cannot keep pace with the population growth. But the knowledge of birth control, through biology education, such as the use of various contraceptive methods is helping many families to control their family size and hence the nation's population (Akpeli, 2019).

Hindrances to Biology Education achieving Sustainable Development in Nigeria.

The problems militating against the achievements of the objectives of biology education include;

1. **Emphasis on passing examinations** to meet the requirements for admission into tertiary institutions. Every year the poor performance of students in the sciences, including biology, in examinations organized by WAEC, NECO, and JAMB is questioned. Very little attention is focused on whether the overall objectives of developing scientific attitudes that will enable the students to function effectively in society are achieved (Oghenevwe, 2022; Aina, 2013).
2. **Shortage of experienced and dedicated manpower.** In addition to teachers, biology education requires well-trained and experienced technologists, craftsmen, technicians, and laboratory and workshop attendants. All these are presently in short supply in the educational system (Aina, 2013). The quality of teaching taking place in our public schools leaves much to be desired (Kola, 2013; Ajayi, 2004). This is why most parents prefer sending their wards to more expensive private schools ((Thom-Otuya, 2010; Sani, 2018). The lack of dedication by teachers has been blamed on poor remuneration and lack of facilities.
3. **The poor state of teacher training institutions.** Institutions such as Colleges of education and universities have often complained of poor teaching facilities and conditions of service which are resulting in brain drain. Several attempts have been made, usually through strikes, to draw the government's attention to these problems. It is therefore not surprising, that the products of these institutions lack the expected competence expected of them (Ahmad et al 2018).
4. **Teaching methods.** Biology education is essentially a practical process requiring a lot of field study and laboratory practices which are presently absent in our schools (Neboh, 2011). The most common teaching method employed by biology teachers is the lecturing method. This is the oldest and most traditional method of teaching, where the teachers

talk and students listen and take notes. Students visit the laboratory only when the biology practical examination is two or three weeks away (Neboh, 20011).

5. **Lack of well-equipped laboratories.** The state of laboratories in our schools leaves much to be desired. If any science subject is to be taught well, it should be taught practically. However, due to a lack of laboratory equipment, practical work does not take place as required (Jegede, 1989; Ahmad, 2018).
6. **Funding.** Poor funding is a factor that generally plagues the education sector. Several strikes by the Academic Staff Union of Universities (ASUU) and others to draw the attention of the government have not yielded much (Akpeli. 2019).

Conclusion

For a country like Nigeria, that is in dire need of sustainable development, it is imperative that the teaching and learning of Biology must be taken seriously in midst of challenges, if the country must be transformed into a technologically developed society. Biology education can play an important role in sustaining development in Nigeria if the right approach is followed.

Suggestions

The following suggestions could provide the necessary solutions to the problems plaguing biology education.

The need for skilled, experienced, and dedicated teachers is central to achieving the objectives of biology education. Our teacher training institutions should be properly staffed and funded. The products of our colleges of education and universities are presently not performing up to the expected standards. There is also a need for special allowances for biology teachers to encourage them to put in extra hours needed for practical and fieldwork.

Biology education requires well-equipped laboratories with a full complement of staff such as technologists and technicians. Government should provide all the facilities needed.

Curriculum experts should incorporate bio-entrepreneurship and bio-economics into biology education at all level of the education ladder.

The private sector needs to partner with the government as part of its social responsibility. Some private sector organisations such as some oil companies have built and donated laboratories to the schools in their host communities. This is commendable and needs to be encouraged.

Government should ensure that funds are adequately budgeted for the education sector. The role of intervention agencies such as the Education Trust Fund (ETF) and the Universal Basic Education Commission (UBEC) is commendable. Apart from making funds available, the agencies must monitor the use of such funds, since the proper use of funds made available is also a major challenge.

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