

SCIENCE AND SCIENCE EDUCATION
IN NIGERIA

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
AUGUSTINE IKECHUKWUKA OKONKWO
1969

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ABSTRACT

SCIENCE AND SCIENCE EDUCATION IN NIGERIA

By

Augustine Ikechukwuka Okonkwo

The purpose of this study was: (1) to study the role of science in Nigeria, (2) to study the current role of science education in Nigeria, (3) to show the relationship between science and science education in Nigeria, (4) to examine how science education can contribute to the solution of the problems and needs of the people of Nigeria, (5) to make proposals for the reorganization of the science curriculum in Nigerian schools at the elementary and secondary levels based upon an analysis of the problems and needs of the people, and (6) to propose a teacher training program for science teachers.*

In order to achieve this purpose, a study was made of the salient features of Nigerian society, including the cultural background of the people, social movements, social institutions, religion and the use of science in Nigeria. The impact of science and technology on the economy and welfare of Nigerian society was examined. The genesis of the Nigerian school system at the elementary and secondary levels and higher education was



described. Further, a study of science education in Nigerian schools including curriculum, methods and materials of instruction, and evaluation was made. Lastly, teacher training was studied.

As a result of the above procedures the following findings were made:

1. The objectives of the science curriculum have centered around the dissemination of facts by the teachers and memorization by the students in order to pass examinations.
2. The syllabi and the examination system have tended to negate the purpose of science education, and have limited the initiative of the teachers and the interests of the students.
3. The content does not fully reflect life conditions in Nigeria and has not been sufficiently related to the needs and everyday life of the students.
4. The methods of instruction and examination method have tended to make learning in science bookish and perfused by rote memorization.
5. In addition to the lack of adequate facilities and equipment for science teaching in many schools, laboratory experiments have been mostly devoid of the scientific experience they should give.



Augustine Ikechukwuka Okonkwo

6. There is lack of genuine concern for the improvement of societal life through modern science.
7. Critical thinking and problem solving techniques have not penetrated deeply into the science curriculum.
8. The science program is plagued by lack of adequate staffing of the schools with science educators and science teachers with sufficient background in science.

✓ On the basis of these findings, the following recommendations were made: science education as based on the current syllabi needs to be revised for a more realistic approach, methods and materials of instruction need to be improved through a better teacher training program and new techniques of evaluation need to be introduced into the program. ✓



SCIENCE AND SCIENCE EDUCATION IN NIGERIA

By

Augustine Ikechukwuka Okonkwo

A THESIS

Submitted to
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for the degree of

DOCTOR OF PHILOSOPHY

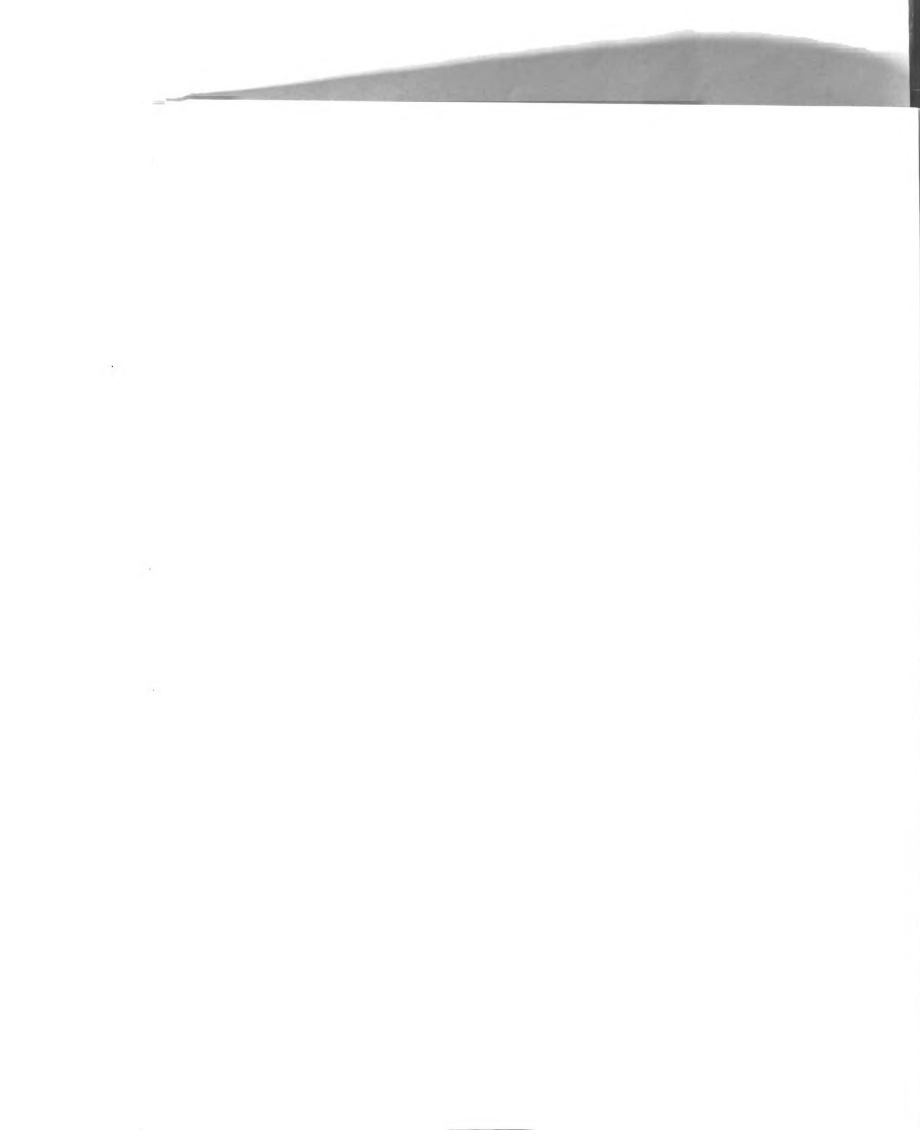
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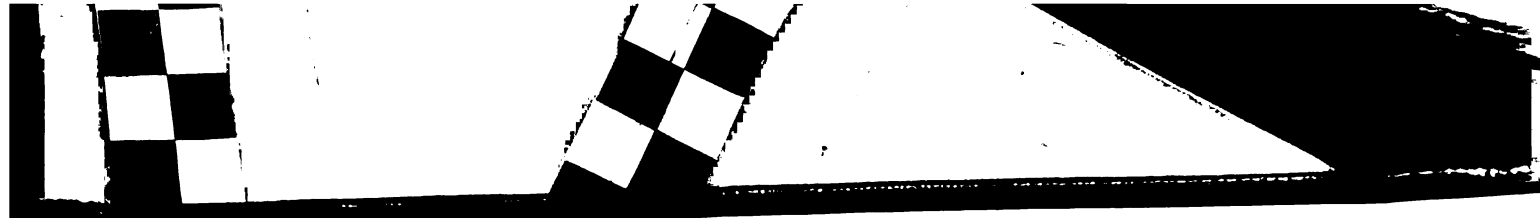
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To My Parents





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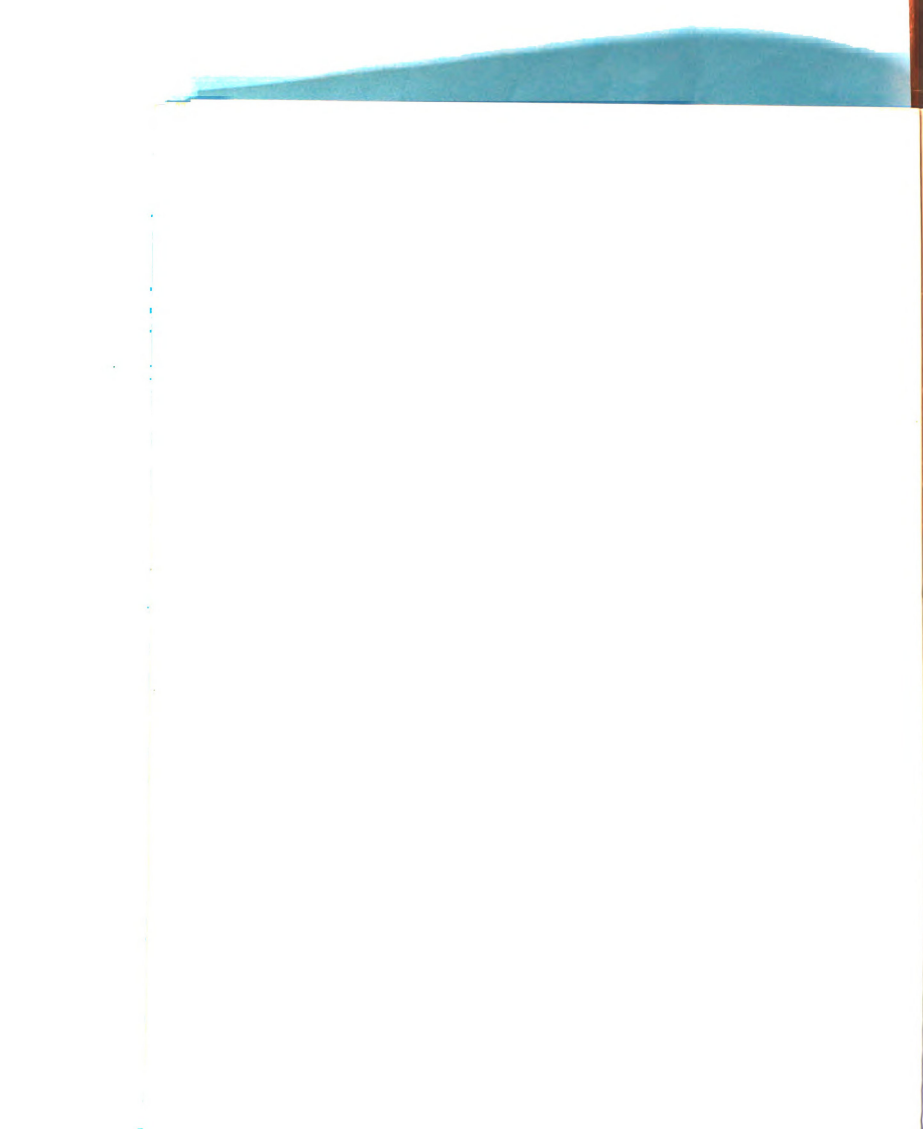
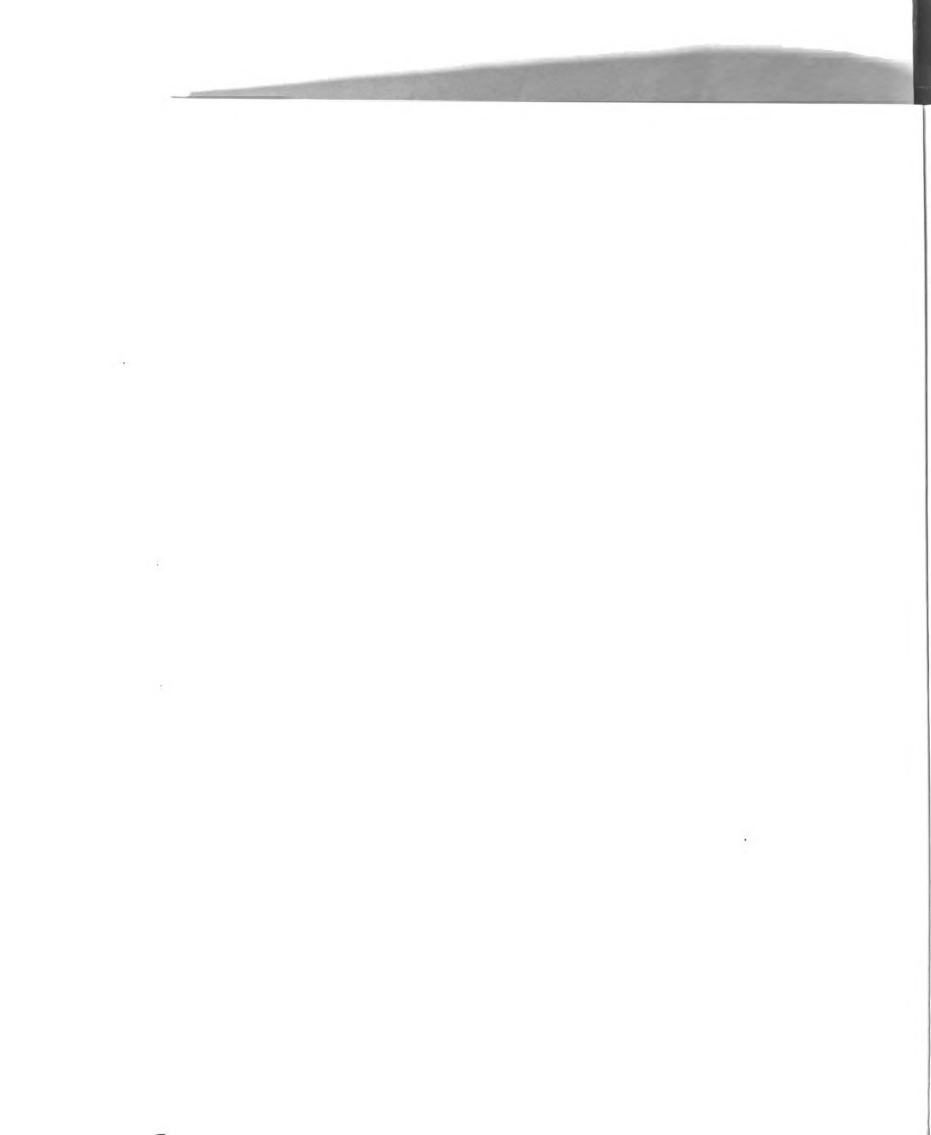


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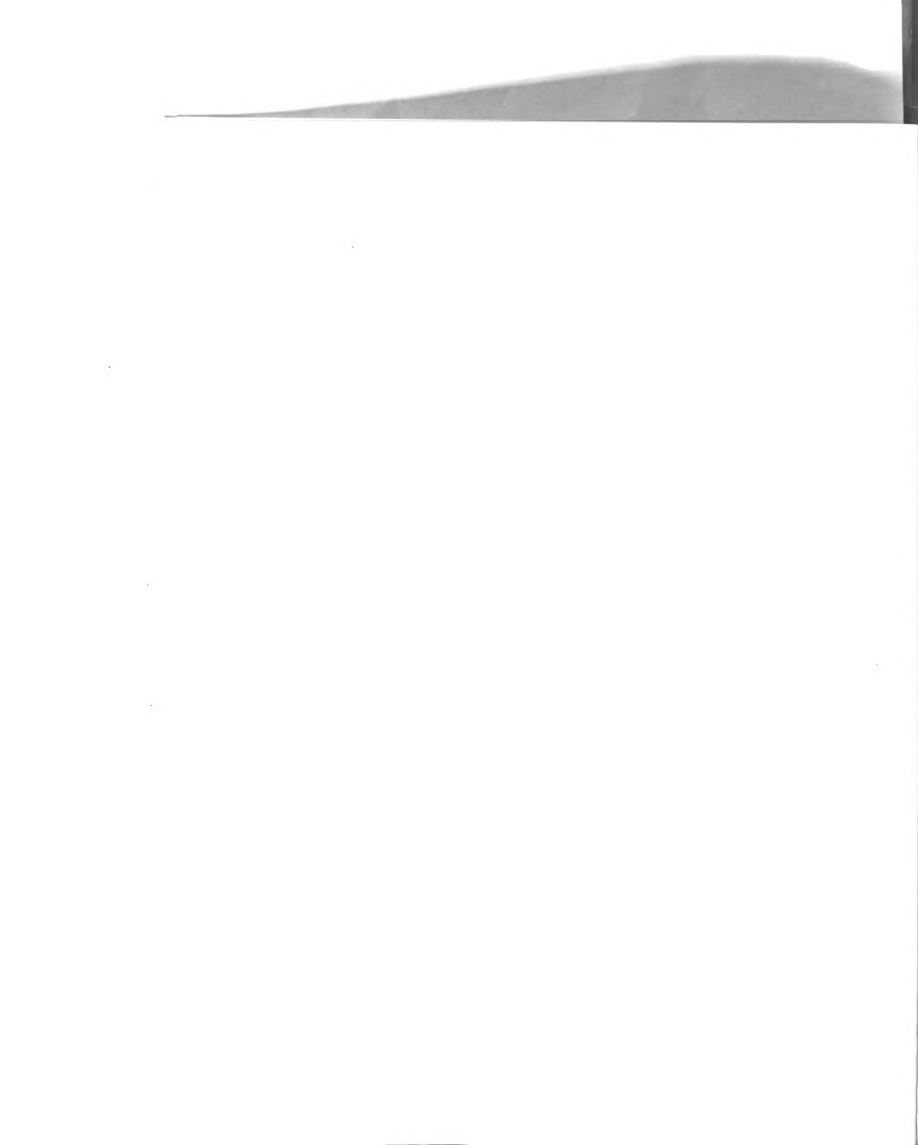
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CHAPTER I

INTRODUCTION

One of the outstanding phenomena of this century has been the growth of science. This has immensely influenced the lives and habits of many people throughout the world. Some diseases which took many lives in the past centuries are now being prevented or cured, while the causes of the diseases have been eradicated in many places. In many areas, health and sanitation have been improved and life expectancy increased through the use of scientific knowledge. Science has enabled man to find appropriate ways of using his natural resources, of raising his standard of living, and of discarding some of his superstitious beliefs about the world and its inhabitants.

Need for the Study

Nigeria is not yet enjoying fully the achievements of science. Some diseases which could have been prevented still plague the people because of ignorance, lack of adequate means of preventing outbreaks or facilities to eradicate the cause of disease. There are unhealthy

and unsanitary practices going on in many places in Nigeria and because the natural resources are not yet fully developed, the standard of living is low. Widespread superstition and a certain amount of social apathy in the face of life problems permeate many phases of life. There is an urgent need for the diffusion of the various aspects of science into the various phases of Nigerian life for the improvement of these conditions. The application of scientific knowledge holds great promise for the transformation of the present conditions into more satisfactory ones, and science education has the potential to play an important role in this endeavor.

Statement of the Problem

The purpose of this study was (1) to study the role of science and science education in Nigeria and to examine how they could contribute to the solution of the problems and needs of the people of Nigeria, and (2) to make proposals for the reorganization of science curriculum in Nigerian schools at the elementary and secondary levels based upon an analysis of the problems and needs of the people and to propose a teacher training program for science teachers.

Procedure

There are certain characteristics of Nigerian society which could influence science education and the progress of

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science and its use in the country directly or indirectly. Chapter II will deal with the salient features of Nigerian society by investigating the cultural background of the people, social movements, social institutions and religion.

The impact of science and technology in the economy of Nigerian society will be examined. Chapter III will deal with the scientific resources that are available to Nigerian people, and the use of science and technology in the economy of the country of Nigeria for developing her natural resources and improving productivity in agriculture and industry. What science education could do in solving the problems of health and sanitation, food and nutrition will be analyzed.

The questions about the prevalent practices in Nigerian schools and the extent to which these schools tend to improve the condition of the people will be approached in Chapter IV. This will be done by giving the school systems and describing them with a historical account of their genesis and development. Education at various levels, including elementary, secondary, vocational, teacher training and higher education, will be studied and described in this chapter.

The place of science education in Nigerian schools at the elementary and secondary levels will be studied. The nature and scope of the content, teaching methods, textbooks, laboratories and instructional materials,

examination system and science teachers will be investigated. Chapter V will deal with the program in the elementary level while Chapter VI deals with that of the secondary level.

In the light of the findings in the preceding chapters, Chapter VII will undertake to make specific recommendations for reorganizing the science curriculum in Nigerian schools and to suggest means of improvement for teaching methods, experimentation and evaluation. Parallel recommendations will also be offered to improve the training of science teachers as well as the selection of textbooks and other instructional materials.



CHAPTER II

NIGERIA AND THE PEOPLE

The educational system of Nigeria hardly can be discussed without paying attention to the salient factors which have inevitably influenced its development. These include the geographical setting, cultural and social institutions of the people, and the implications of population changes. Many of the problems confronting Nigerian education have their genesis in the above named factors. Therefore, this chapter will deal with those features of Nigerian society which have influenced education.

The Geographical Setting

Nigeria has an area of 356,670 square miles and is situated on the west coast of Africa. On the west and north the country is bordered by the Republics of Dahomey and Niger; on the south it is washed by the Gulf of Guinea; and on the east it adjoins the Cameroun Republic. Its greatest length from south to north is 650 miles, and its maximum breadth from east to west is rather more than



750 miles. Nigeria lies wholly within the tropics between latitudes 4°N and 14°N .¹

✓ The climate of Nigeria is explained normally in terms of the seasonal shifting of pressure belts in response to the movement of the overhead sun, with added monsoonal tendencies during the months of the northern summer. According to Buchanan and Pugh² it has been restated in terms of the Equatorial Maritime and Tropical Continental air masses. The boundary between these two is known as the Intertropical Front and in this part of Africa, even in mid-winter, this front remains north of the Equator. The Equatorial Maritime air mass is characterized by southwesterly winds coming to the land off the Gulf of Guinea, and these are the main rainbearing winds of the region. The Tropical Continental mass is that of the dry northeasterly winds known as the Harmattan.

There are two major seasons in Nigeria. The Wet Season of the northern summer months occurs when the Intertropical Front has retreated northwards and in July and August, the whole country is traversed by southwesterly winds. The Dry Season of the winter months takes place

¹W. A. Perkins, and Jasper H. Stembridge, Nigeria: A Descriptive Geography (2nd ed.; London: Oxford University Press, Ibadan, 1962), pp. 1-2.

²K. M. Buchanan and J. C. Pugh, Land and People in Nigeria (London: University of London Press Ltd., 1955), p. 21.

when northeasterly winds cover the whole of the northern part of the territory and may even break through to the coast on a few days during the height of the season. In the south the wet season lasts from March to October; in the north, from June to September. Though the wet season is the time of the year when most rain falls, there may be dry and sunny days as well as cloudy and rainy ones. Similarly, though the dry season is the period when least rain falls, this season may not be completely dry and there may be occasional rainy days.³ The average annual rainfall varies from about 160 inches in the southeastern coastal belt to 60 inches in the east and west, and 25 inches in the extreme north.

The highest temperatures occur normally in April in the north and a little earlier in the south. Throughout Nigeria the hottest months are those just before the wet season begins. With the coming of the rains temperatures fall slightly, partly because the rain helps to cool the air, but mainly on account of the large amount of clouds in the sky, since clouds shut off some of the sun's rays during the day. In the coastal belt the length of the wet season and the cool influence of the sea, both help to reduce the temperature.⁴

³Perkins and Stembridge, op. cit., p. 42.

⁴Ibid., p. 46.

The vegetation zones are as varied as the annual rainfall. The south has an area of swamp and mangrove forest with an undergrowth. The mangrove forest is present along the greater length of the coast line attaining its maximum extension in the maze of anastomosing creeks and inlets in the Niger delta. The forest is dominated by red mangrove which, under favorable conditions, may attain heights of 150 feet, but for the most part the forest is lower and in places is little more than a low growing tangle of mangrove shrubs. The freshwater swamp forest forms a more or less continuous zone between the mangrove belt and the rain forest. It is characterized by stilt-rotted trees with a dense undergrowth of shrubs and lianes where the canopy is open. *Raphia* and climbing palms are very typical of this zone. The swamp forests play an important role in the local economy as a source of pit-props and of fuel for the coastal settlements.⁵

Further inland is the rain forest zone. The trees include hardwoods such as the mahogany, the African walnut, sapelewood, sassafras and the obeche. The region has many palms of which the oil palms are outstanding. They do well where there is an annual rainfall of at least 60 inches, no marked dry season, and an average annual

⁵Buchanan and Pugh, op. cit., p. 34.

This image shows a blank, aged, cream-colored page, likely an endpaper or flyleaf of a book. The paper has a slightly textured appearance with some minor discoloration and faint smudges, characteristic of old paper. The left edge of the page is bound, showing a dark, possibly leather or cloth, cover. There is no text or other markings on the page.

temperature above 80°F. To the farmer in these parts prosperity means a good oil-palm crop, oil for cooking and lighting, kernels for sale. Cocoa trees are grown in this zone⁶ although serious inroads have been made into the forest by centuries of shifting cultivation.

Beyond the forest zone, as the annual rainfall decreases and the dry season lengthens, the rain forest gradually gives way to a belt of open woodland and savannas. Further north the land becomes more open, with a general elevation of about 2,000 feet, and certain parts of the central plateau rising to over 5,000 feet above sea level. It is in this region that cotton and groundnuts are produced. In the far north the country merges into the Sahara desert and slopes gently to the shores of Lake Chad on the northeast border of Nigeria, where frost is occasionally experienced.

The River Niger, with its main tributary the Benue, is the most prominent physical feature of Nigeria. Both are affected by the rainfall and a difference of about 35 feet between high and low water has been recorded. The Niger rises in the mountains to the northeast of Sierra Leone, and for the first two-thirds of its great length of 2,600 miles flows through other African countries.

⁶Perkins and Stembridge, op. cit., p. 55.

20. 2. 1950

21. 3. 1950

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The People

Nigeria has a population of about 55 million people.⁷ The population is composed of several groups distinguished by custom, tradition and language. Within the large language groups, many dialects are spoken. But the differences between these dialects are seldom great, and a person speaking one of them can usually understand another person who speaks a different dialect of the same language group. There are, however, many minor languages that bear little or no relation to the main language groups.

The principal groups, in order of numbers, are the Hausa, Ibo, Yoruba, Fulani, Kanuri, Tiv, Ibibio, Edo, Anang, and Nupe.⁸ Among the groups found in the south, the Yorubas occupy most of the country lying southwest of the Niger, where many live in towns and cities, such as Akure, Ibadan, Abeokuta, Ogbomosho, Oyo, and Shagamu. The Ibos are the largest group in the south. They live mostly in the southeast of the Niger in an area extending from the lower Niger to the Cross River, and in some parts of the western section of the south. They live in towns and cities such as Agbor, Asaba, Onitsha, Enugu, Owerri, Umuahia, Aba, and Port Harcourt. The Edos live in and around Benin in the mid-west section of the south. The coastal belt, west

⁷Sir Rex Niven, Nigeria (London: Ernest Benn Limited, 1967), p. 249.

⁸Perkins and Stembridge, op. cit., p. 3.

of the Cross River, with its creeks and mangrove swamps, is inhabited by the Ibibios and the Anangs. In the Niger Delta dwell the Ijaws.⁹ In the Creeks of the Delta, where there is little dry land, are the Itsekerri and Urobo.¹⁰

The most numerous of the inhabitants of northern Nigeria are the Hausas, followed by the Fulani and the Kanuri of Bornu. Some of the people live in towns and cities like Bornu, Kaduna, Kano, Katsina, Zaria, Sokoto and Maiduguri. Besides these largely Muslim peoples, there are non-Muslim people, many of whom live on the Jos Plateau, where in former days they sought refuge from the more powerful Muslim peoples. The Nupes live north of the middle Niger, and their chief city is Bida. North and south of the middle Benue is a tract of well-wooded savanna country inhabited mainly by Tivs. Some dwell in villages, but many live on farms. The Tivs differ from the Hausas in religion, since among them Islam has made little headway.¹¹ Beyond the Tivs eastward come the Jukuns.¹²

The division of the people of Nigeria into different groups are accompanied by cultural differences and linguistic differences that have a bearing upon the attitudes

⁹Ibid., p. 5.

¹⁰Niven, op. cit., p. 15.

¹¹Perkins and Stembridge, op. cit., pp. 5-7.

¹²Niven, op. cit., p. 15.

and relationships between the different sections of the country. Buchanan and Pugh have stated that the cultural pattern of the territory shows a richness and diversity paralleled in few African territories, and one which is of fundamental importance in its constitutional development.¹³

The differences between the languages have not been helpful. According to Lewis, they are such that the evolution of a single Nigerian language as the national language was and is not possible. In the schools the early stages of instruction are carried out in the major language of the district. English becomes the language of instruction in the upper levels of the school system at different stages in the different regions. It is also the language of government, administration, commerce and industry, with the caveat, that at local levels of activity the indigenous language may be used.¹⁴

Religion

The religious beliefs of the people are so diverse that they have added a further element of complexity to the cultural pattern of Nigeria. Lewis has stated that in the north, Mohammedanism is the dominant religion, and

¹³Buchanan and Pugh, op. cit., p. 79.

¹⁴L. J. Lewis, Society, Schools and Progress in Nigeria (Oxford, London, Edinburgh, New York, Paris, Frankfurt: Pergam Press, 1965), p. 16.

its concepts are the basis of the family and the general social structure. Within the Islamic society the emirs still exercise feudal rights of overlordship. Pockets of older indigenous groups of inhabitants have survived who still practice the animistic religions and organize their lives upon clan patterns of society. In the western section of the country the religious affiliations of the people are divided approximately equally between Islam, Christianity and indigenous animistic faiths. In the mid-western and eastern sections of Nigeria, Christianity and animistic faiths are almost equally supported, while Islam has gained little support.¹⁵

Social Structure

Among the people of Nigeria, family ties play a great part in everyday life, even transcending national or group loyalties in moments of crisis. The family in this instance does not mean only immediate blood relations. It is common to hear a man talk of his brother when he simply means someone from the same village or even clan, but that relationship is sufficient for the one to help the other in whatever way is needed.

The native Nigerians make up the majority of the inhabitants of the country, and they all enjoy a great degree of social fluidity with no barriers between one socio-economic class and another. Obvious is the

¹⁵Ibid., pp. 15-16.

existence of vast contrasts of wealth, poverty, education and illiteracy among the people. Nevertheless there are flexible and frequent movements for individuals from a lower to a higher socio-economic class. Post has pointed out that the gulf between rich and poor is not yet serious enough to cause a crisis, and is mitigated--above all perhaps in the north--by social relationships which are difficult to explain in terms of class.¹⁶

Implications of Population Changes

The average density of population in Nigeria is about 93 persons per square mile. Density variations occur between the different sections of the country and within each section. Lagos with 1,280 people to the square mile has the highest density. For the eastern section of the country the figure is 269, the western 14.8, and the northern 67. The majority of Nigerians live in agricultural areas, but at the time of the 1952-53 census nearly 6 million people, or 19 per cent of the population lived in 350 towns of 5,000 or more people.¹⁷

It is somewhat of a paradox, according to Buchanan and Pugh¹⁸ that Nigeria, with the type of density it has,

¹⁶K. W. J. Post, "Nigeria Two Years After Independence," The World Today, (December, 1962), 254.

¹⁷British Information Services, Nigeria: The Making of a Nation, June, 1960, pp. 4-8.

¹⁸Buchanan and Pugh, op. cit., p. 77.



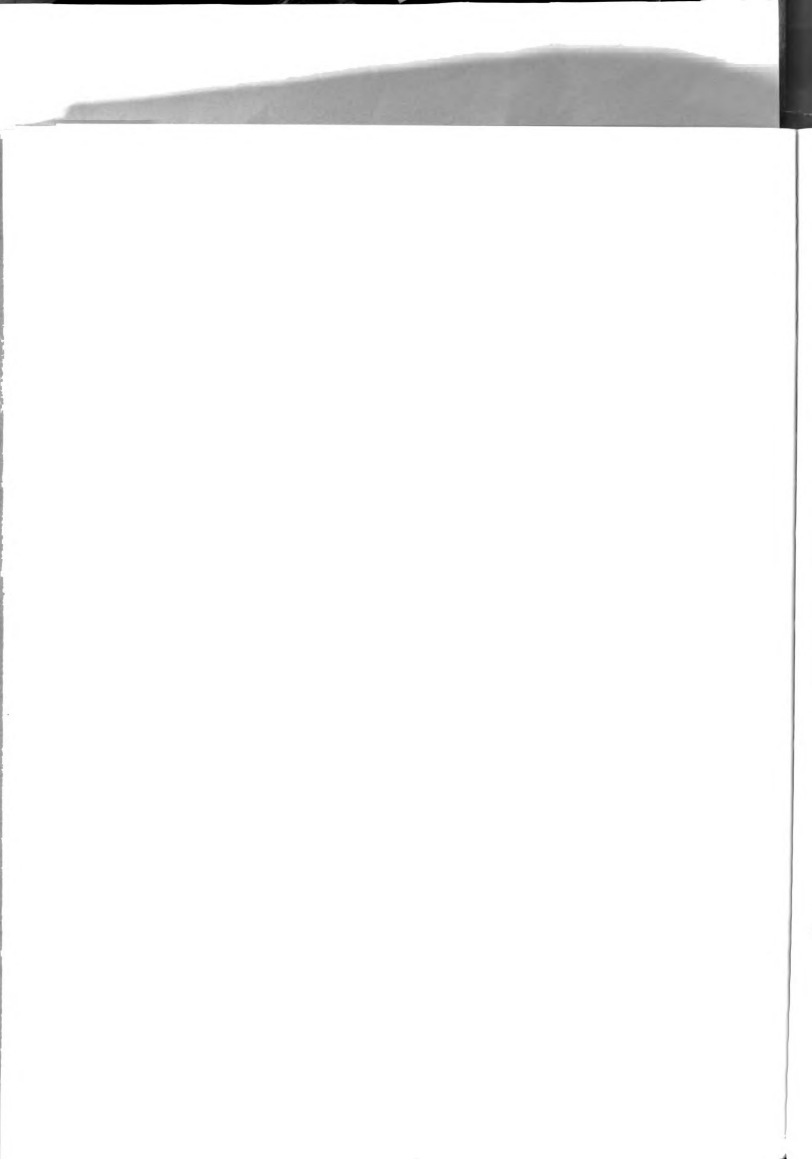
should be confronted with the problem of over-population, even on a local scale. Yet in a few places population is pressing dangerously upon resources. In the eastern section of the country, over-farming and a high density of population has led to the replacement of the original rain forest by a grass vegetation and to severe and widespread gulley erosion. In the most crowded areas some redistribution of population seems inevitable, and in this connection it is noteworthy that densities drop sharply towards Ogoja area and the eastern part of Calabar. It has, however, to be demonstrated that these empty areas have an adequate carrying capacity, and that population transfer on a large scale is feasible in the present social context. In the areas of moderate population density, replacement of existing farming methods by a system which will maintain fertility is imperative, but such a development is rendered difficult by the intractable and impoverished character of the soil.

In Tivland there is an average density of only 65 per square mile, but as a result of the migratory history of the tribe, population is extremely unevenly distributed, and in the southern sectors densities of 175-200 per square mile have been recorded. This density is not excessive but the farming system of the Tiv is, however, extensive and with the expansion of cash-cropping has become more land-demanding. As a consequence, fallows have been

reduced in duration, the original savanna vegetation does not regenerate and is replaced by grass, and soil deterioration in these more densely peopled districts has become serious. The obvious control measures will include redistribution of the population and intensification of farming methods by the development of green manuring and mixed farming. Unfortunately, any redistribution of population, even within the tribal territory, appears unacceptable on account of their social and religious organization.¹⁹ Here, again, the problem is not insoluble, but the time factor is critical.

In the densely peopled zone around Kano City, heavy manuring appears to be maintaining the soil in a rather precarious state of balance. That the excessive concentration of human or livestock populations upon restricted areas may lead eventually to vegetation and soil degradation is readily appreciated. It is less readily appreciated that reduction of population below a certain level may create problems no less serious, though of a different character. The control of tsetse is possible only if the population is sufficiently dense to maintain a certain level of brush clearing; if population drops below this level, and man's pressure is reduced, the bush becomes more dense, an increase in the game population follows, and the fly, taking advantage of the more favorable

¹⁹Ibid., p. 78.



conditions, extends its domain. This minimum density of population probably varies with the density of the stream network (stream-side bush being one of the main strongholds of the fly); in the Anchau area, near Zaria, the critical density has been estimated at 70 per square mile. It is significant that over much of the Nigerian Middle Belt, the main endemic area for sleeping sickness, densities are well below this minimum.²⁰

One consequence of maldistribution of population, as Lewis has stated, is that whilst the country as a whole is self-sufficient in food production, some areas suffer from underproduction. Additionally in consequence of the variations in population density, it is difficult to provide and develop the social services to the best advantage of the community as a whole.²¹

Establishment of the British Connection

The first Europeans to visit the Nigerian coast were the Portuguese in the fifteenth century. They reached Lagos in 1472 and thirteen years later they made their first journey to Benin. Perkins and Stembridge²² have stated that in the latter half of the sixteenth century

²⁰Ibid., p. 79.

²¹Lewis, Society, Schools . . ., op. cit., p. 7.

²²Perkins and Stembridge, op. cit., p. 8.

the Portuguese were followed by the English, French, Dutch, and Danes, who were attracted by glowing reports of rich profits to be made by trading in spices, gold, ivory, and palm oil.

The Bight of Benin was reached in 1553 by the first English ships under the command of Captain Windham. Throughout the sixteenth and seventeenth centuries only the coast was known, because it was accessible to the European traders. The exploration of the interior of the country by Mungo Park, Clapperton, the Lander brothers and others, between 1796 and 1857, made possible the opening of the interior to trade and missionary activity, which was often strong in areas well outside British jurisdiction. Trade prospered in spite of many obstacles and discouragements. The export of palm oil, for example, increased from 55 tons in 1785 and 1,000 tons in 1810 to some 20,000 tons in 1842.²³ The steps by which British administration spread inland, through the activities of the Foreign Office, the Colonial Office and the Royal Niger Company, to the limits of the present Federation of Nigeria, is shown in Figure 1.²⁴

In 1879 private British trading interests, in the face of the challenge of two French firms supported by the French Government, amalgamated to form the United

²³British Information Services, op. cit., p. 6.

²⁴Ibid., p. 7.

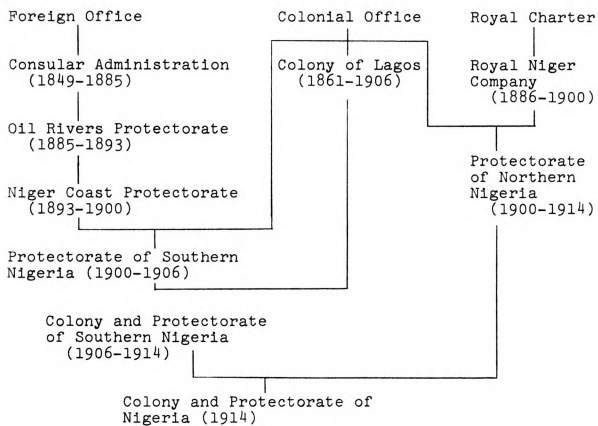


Figure 1.--The Emergence of Nigeria.

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Africa Company. In 1884 the latter bought the French interests. In 1886 the United Africa Company received a royal charter and became the Royal Niger Company. As a result of the Berlin Conference, the coastlands known as the Oil Rivers became a British protectorate under the control of the Royal Niger Company.²⁵ The Company had full rights of administration, with police, judges and prisons, the power to raise taxes and in fact to carry out all the functions of a government.

It has been pointed out by Niven that the Company's area ran from Onitsha up the rivers as far as one could go, that is to Jebba on the Niger and Ibi on the Benue.²⁶ It had little influence away from the rivers. Well aware of this, the French determined to make a great effort to get through to the Niger above Jebba, and so cut the British system and gain much advantage for themselves. Captain Lugard, who had much experience in Eastern and Southern Africa, was sent out by the British Government to defeat this threat. His swift movement in the latter half of 1894 became known as the "race to Nikki," a town west of the Niger, the key point in the French advance.²⁷ He beat the French to the target

²⁵Perkins and Stembridge, op. cit., p. 20.

²⁶Niven, op. cit., pp. 66-67.

²⁷Ibid.

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because they were five days late, a galling experience. Having got there first, Lugard signed a treaty of friendship with the paramount Chief of Borgou, whose capital was at Nikki. As things turned out, however, it was the French who held the area round Nikki, but the rest of Borgou remained British and the Middle Niger also was safe for Britain.²⁸

The Royal Niger Company had its main base at Burutu in the Delta, near Warri, and its headquarters at Asaba, on the Niger opposite Onitsha. According to Niven the Company's premises were freehold by right of occupation, and later confirmed by law.²⁹ For a period of time it was the only freehold in the entire country. On the first of January 1900, the Royal Niger Company surrendered its Charter and Lugard was appointed head of an entirely new government, that of Northern Nigeria. Because it was technically only a Protectorate, he was a High Commissioner and not a Governor and ruled by Proclamation and not by Ordinance, as was the custom in the Colonies. It made little difference to his absolute power; he had no legislature, nor was one set up. The terms of British protection ultimately enforced in the north included the abolition of illegal trade and the recognition of British suzerainty, coupled with an assurance that Moslem religion

²⁸Ibid., pp. 66-67.

²⁹Ibid.

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and the existing system of law would not be interfered with.³⁰

In an area covering the Niger delta and adjoining districts further east was the Oil Rivers Protectorate which had been recognized at the Berlin Conference in 1885. In 1893, protection was extended to its hinterland and the territory renamed the Niger Coast Protectorate. When, in 1900, the northern territories were consolidated and extended, and became the Protectorate of Northern Nigeria, its southern territories were incorporated in the Niger Coast Protectorate, and renamed the Protectorate of Southern Nigeria. Lagos and its protected territory were amalgamated with the Protectorate of Southern Nigeria in 1906 to become the Colony and Protectorate of Southern Nigeria.³¹

In 1914 the Protectorates of Northern and Southern Nigeria were amalgamated as the Colony and Protectorate of Nigeria. When Nigeria became one country, it was divided for administrative purposes into two regional groups of provinces, the Northern and the Southern. However, in 1939 the latter group was split up into the Western and Eastern Provinces. Nigeria became a Federation in October, 1954, and an independent country in October, 1960.³²

³⁰Ibid.

³¹British Information Services, op. cit., pp. 6-7.

³²Perkins and Stembridge, op. cit., p. 12.

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Granting of Independence by Britain

The granting of independence to Nigeria by Britain has been described by Bretton thus:

Although, in strickly legal terms, Nigeria's accession to independence on October 1, 1960, warranted special notice--since a legal transfer of some aspects of power did indeed take place then--in terms of real, substantive political power and control, and of economic power and influence, the event lacked the significance popularly attributed to it. Under the conditions worked out between British and Nigerian interests, extensive preparation had been made for the transfer of governmental and administrative responsibilities to the Nigerians on a piece-meal basis. True self-government had been brought to the territory several years before formal independence was granted--first to the southern, then to the northern parts; consequently, many of the lesser attributes of rule had already been transferred, and others, it was mutually agreed, did not have to be transferred immediately. Economic and military powers, for instance, were substantially retained by the British in one form or another, and the Nigerians, because of a rather delicate internal political balance, found such a "staggering" of the processes of power transfer politically convenient. Thus, it cannot be said that October 1, 1960, saw the emergence of a brand-new political regime in Nigeria or of brand-new political patterns and relationships. The roots of government were not torn up on independence day, nor were entirely new roots planted. Therefore, a valid examination of Nigeria's political processes must take into account the presence of the British before, during, and for some time after independence.³³

The granting of independence to Nigeria by Britain, like the colonization of the country, did not remove the basic problems plaguing the people. The perpetual animosities existing between the language groups, or

³³Henry L. Bretton, Power and Stability in Nigeria. The Politics of Decolonization (New York: Frederick A. Praeger, Publisher, 1962), pp. 3-4.

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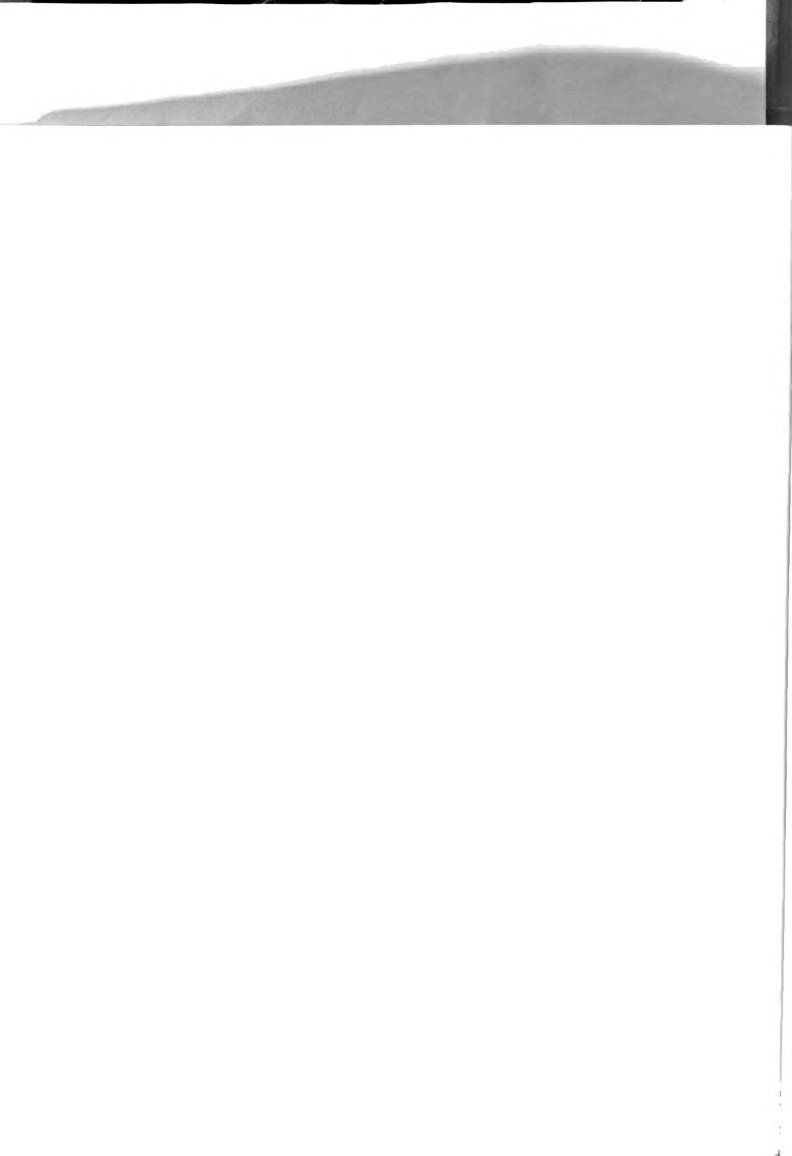
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tribes as they are often called, the jealousy and in fact the high handedness and naked power perpetrated by some people in order to satisfy their whims continued to exist. The Western world chose to call Nigeria an African democracy, but, as Bretton has pointed out:

In fact, Western democracy never really operated in any colonial areas; instead, the substantially altered modes of government and administration that did operate were far more traditional and far more authoritarian than appeared to be permissible under the provisions of the formal structure. Any attachment to modern, Western democratic principles professed by Nigerian leaders and opinion-makers may be extremely superficial. In fact, the slightest ideological push, the application of the slightest counterstimulant, reveals, in most instances, a total lack of comprehension of the implications of personal political conduct, under conditions of democracy. . . . The Northern Region was permitted to lag behind in every respect; there the social structure was quite incompatible with modern legal and political concepts, institutions, and processes. Even if universal franchise alone had been effectively applied, it would have produced revolutionary situations that neither the British nor their partners in the southern parts of the territory were prepared to handle. At the time of independence, therefore, Nigeria represented a federal organism that accorded the Northern Region distinctly differential treatment, permitting the Islamic feudal rulers of the north to retain their supreme positions subject only to modest restrictions imposed in the common Nigerian interest--"interest" in that sense being rather narrowly interpreted in favor of retaining the status quo.³⁴

The government of Nigeria was not thoroughly understood by the outside world. The internal strife was camouflaged by the government, Britain and all others who chose to propound the myth about what was regarded as

³⁴Ibid., pp. 16-19.



democracy in Nigeria. For, as the so-called democracy was in progress, people were being prevented from voting; people were being jailed because they voted against the politicians who wanted to be in power all their lives; elections were being blatantly rigged, and even the national census was not without blemish. Gronze has commented, "The reader will be surprised to learn that the population of Nigeria was 39 million in 1962 (it was, of course, somewhere around 55 million according to the controversial census of 1963-64)."³⁵ In summing up his views about power and stability in Nigeria, Bretton has stated that:

The substance of the political arrangement under which Nigeria became independent may be summarized by the terms moderation and compromise. But Nigeria, it is submitted, already has entered a period of social-revolutionary pressure and upheaval. Moderation and compromise on essentials, on fundamentals, under such conditions, are least likely to produce political stability. All that may be achieved is a postponement of unrest, riot, and a general showdown among the principal contenders for power. It is vitally important that the temporary tranquility is not mistaken for a solution of Nigeria's problems; it should not even be allowed to be represented as a valid base for future solution of basic problems. At best, a policy of moderation and compromise serves the political Cold War interests of the West in the narrowest possible sense. Real progress toward lasting stability in Nigeria requires, among other things, the separation of Cold War

³⁵Collin Gronze, Preface for Nigeria--Model of a Colonial Failure by Stanley Diamong (New York: American Committee on Africa, 1967), p. vii.

objective and strategems from the real social and political engineering problems awaiting solution for their own sake.³⁶

According to Diamond, Nigeria is a model of a colonial failure. He has explained his contention thus:

Nigeria's "moderation," the vaunted "conservatism" of Northern leadership, the well-publicized "democratic character" of the coalition have all been political myths, sanctioned by legal and constitutional documents. For the fact is, that the majority of Nigerians did not participate effectively in their own government; under the cloak of a tradition, which was little more than a heritage of domestic conquest, the Northern leadership utilized every conceivable political weapon to maintain its power. Nigeria, held together in an absurd and corrupt coalition, had forfeited that vanguard role that ordinary Africans, within and beyond its borders, had logically anticipated. In reality, Nigeria was the very model of a colonial failure. The federation was imagined to be a colonial success, an example of how well-intentioned power, sober and lofty design, can create a nation and move a people, with minimum displacement, from a position of tutelage to one of "independence" through which the best interests of rulers and ruled are harmoniously united. Nigeria was the example cited by journalists and politicians throughout the Western world, of the "positive" force in Africa, as the standard against which we invidiously compared the developments that we neither understood, nor had compassion for, in other African states. Until recent events forced themselves on our attention, Nigeria projected a remarkably quiet image, a projection that was advantageous to the domestic leadership and to those metropolitan powers who were depending upon the country as a counterweight to the more radical forces in Africa. That image has now been shattered, through a succession of events, deeply rooted in the colonial enterprise.³⁷

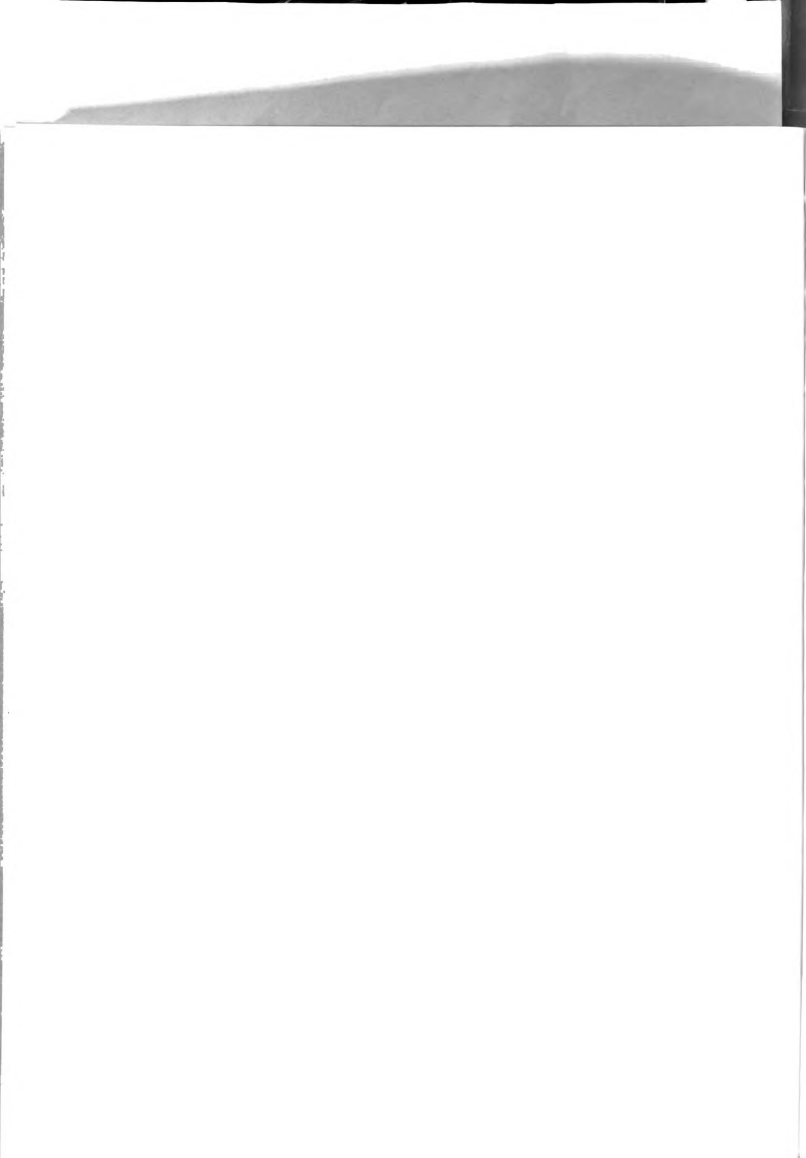
³⁶ Bretton, op. cit., p. 182.

³⁷ Stanley Diamond, Nigeria--Model of a Colonial Failure (New York: American Committee on Africa, 1967), p. 6.

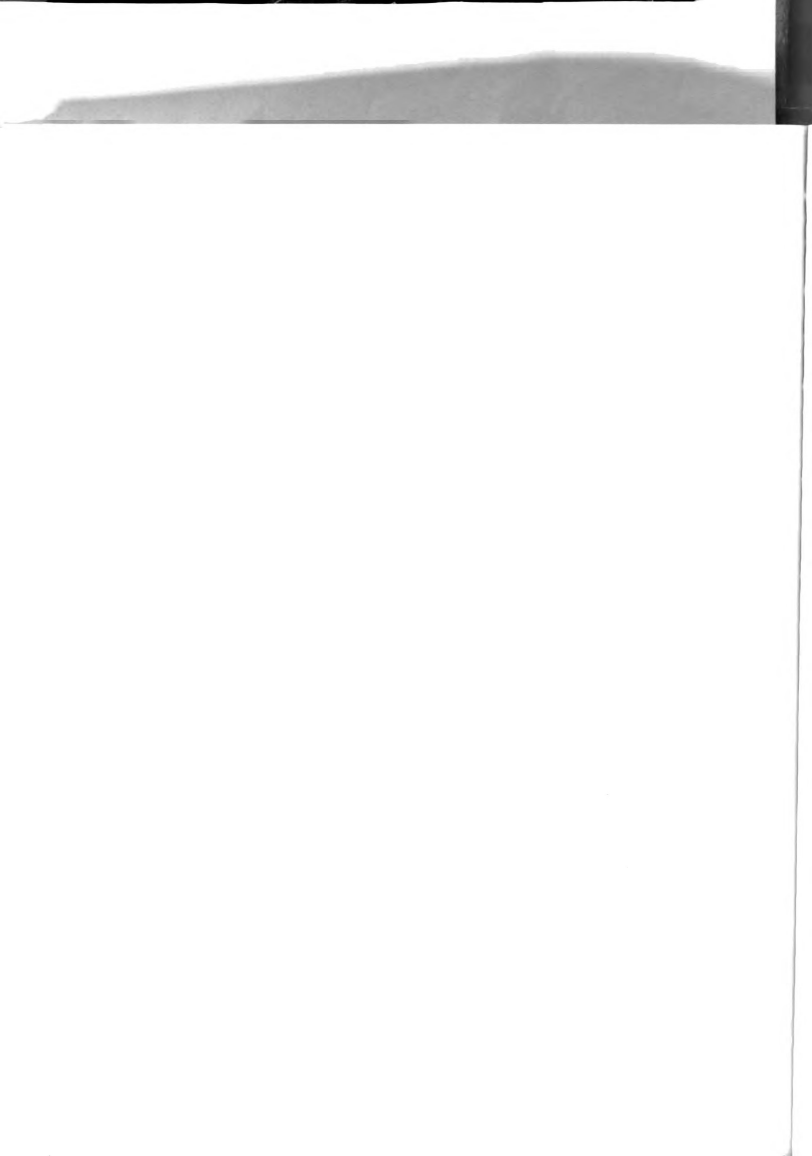
Such was the Nigerian dilemma which culminated into one of the most tragic wars in modern times, the war between Biafra and Nigeria. The Republic of Biafra was formed by the people of the former Eastern Region, who were compelled to do so after thousands of their people were murdered in different parts of Nigeria. Nigeria invaded Biafra on July 6, 1967. McLaughlin, who was in Biafra for several days in December, 1967, called the war one of the most humanly costly and stated that K. H. Jaggi, chief delegate of the International Committee of the Red Cross in Biafra had publicly described Nigeria's air attacks on Biafra as having certain overtones of genocide. Bishop Joseph B. Whelan of the Owerri Diocese in Biafra, according to McLaughlin, visited Ihiala after a bomb attack by Nigeria on an open air market full of civilians, and called the attack a flagrant violation of God's law and man's conventions.³⁸ Shepherd has described the war as the bloodiest and biggest conflict in the history of Africa and stated that "Britain, despite furious opposition from its own citizens, is a major supplier of modern weaponry to Nigeria. So is the Soviet Union."³⁹

³⁸ John McLaughlin, "Report from Biafra," America, CXX, 4 (January 25, 1965), 90-91.

³⁹ Jack Shepherd, "Memo from Nigeria: Old Headache for Our New President," Look, XXXII, 24 (November 26, 1968), 74.



The war is still going on at the time of this writing. It has been a tragic war which may never remove the basic problems which precipitated it. What the end will be cannot be predicted, but history will tell.



CHAPTER III

SCIENCE AND TECHNOLOGY IN THE ECONOMY AND WELFARE OF NIGERIAN SOCIETY

The impact of science and technology in the economy and welfare of mankind during this century cannot be ignored. Man has seen great changes and improvement in health, agriculture, industrialization, development of natural resources and improvement of living conditions, but these changes and improvements have not penetrated deeply into Nigerian society. The problems are compounded by an acute shortage of trained manpower. Onyemelukwe has described the situation thus:

In Nigeria--as in many of the underdeveloped countries--the impact of technology in the last forty years or so has been comparatively small. Universities in Nigeria now produce graduates in chemistry and physics who end up either teaching another generation of theoretical chemists and physicists, or in white-collar jobs. They are training more and more lawyers, historians, artists, linguists, most of whom are in control of policy. There is a general complacency amounting to indifference to technological change which is hard to understand. The sort of national impatience required in an era of change is virtually absent. Most of the economic assets of Nigeria in terms of natural resources and manpower remain untapped. Politics has been the preoccupation of too many people. It is estimated that it will take something like another fifty to sixty years for

countries like Nigeria to approach anything near the present standards of some of the advanced countries, even assuming a higher rate of economic activity than is possible at present. That brings us to the first or second decade of the next century.¹

It should be added here that with the present civil war going on in Nigeria, in which many lives have been lost, hospitals, churches, schools and other educational institutions damaged, roads, bridges and factories destroyed, and national debts accumulating, it may take Nigeria more years than had been anticipated to overcome its economic ills and social problems resulting from them. The purpose of this chapter is to describe the economic conditions of Nigeria--its agriculture, food and nutrition, health and sanitation, industry, manpower needs, and what science and technology can contribute in alleviating some of the problems.

Agriculture

The bulk of Nigeria's agricultural production represents the output of millions of farmers whose holdings are small and scattered. They mainly depend on a shifting system of cultivation and use of the simplest tools.² The Nigerian farmers are largely subsistence farmers,

¹C. C. Onyemelukwe, Problems of Industrial Planning and Management in Nigeria (London: Longmans, Green and Co., Ltd., 1966), p. 3.

²The Royal Institute of International Affairs, Nigeria: The Political and Economic Background (London, Ibadan, New York: Oxford University Press), p. 90.

cultivating between three to five acres a piece annually and probably making a gross cash income of some £15 to £20 (about \$42 to \$56) per head after they have fed themselves and their families.³ Large-scale agricultural units, therefore, seem to offer many economic advantages to Nigeria.

The improvement of agriculture is a basic necessity. In order to raise living standards, and to keep up with population growth, productivity should be increased. The methods used are mostly primitive, bringing low yields and are also responsible for potentially productive land lying idle. Science education has an important role to play in solving some of the agricultural problems facing Nigeria. The use of manure and fertilizer for supporting intensive farming should be included in the science program of the schools and the student should carry out practical experiments using manure and fertilizer to grow crops in the school farm. The knowledge gained should be made available to the farmers, who should be encouraged to use manure and fertilizer on their farms. Crop rotation and ridging should be practiced by students on the school farm and the knowledge gained used in helping the farmers.

³Colonial Annual Reports, Nigeria 1952, Her Majesty's Stationary Office, London, 1954, p. 36.

The problem of insect pests plagues agricultural development. Swollen shoot disease, a complex of viruses transmitted by mealy bugs, has caused some damage to cocoa. Black pod disease caused by a fungus Phytophoea palmivora, is another potential danger to cocoa industry. The capsid insect of the varieties Sahlberquella singularis and Distantiella theobroma has caused some damage to cocoa plants. The production of cotton has been hampered by the attack of some insect pests such as Dysdercus supersticiosus and four other types of bollworm, including the pink Platydera gossypiella, the spiny and American bollworms, and the false codling moth. Many crops have been destroyed by locusts, grasshoppers, corn borers and yam beetles. Crop production will increase when solutions to the problems caused by insect pests are found. What the use of scientific knowledge can do in solving some of the problems will include the study of the insect pests--their life histories, methods of attacking the crops, seasonal occurrences--and the methods of controlling them both biologically and by using pesticides.

The prevalence of the tse tse fly over three-quarters of Nigeria limits the majority of cattle to the tse tse fly-free dry savannah area of the northern section of the country. Such cattle as are found in the eastern section are mainly dwarf Muturu, which are tolerant to trypanosomiasis but provide little milk. In the western section

the cattle are mainly a cross between Muturu and Zebu.⁴ The increase of beef production is important. Selective crossing of different breeds including foreign stock, and mass vaccinations in order to increase resistance to endemic diseases are some of the scientific undertakings which will help to bring about increased beef production. Projects designed for the eradication of tse tse fly will also facilitate improvement in the breeding of cattle. Improved methods of raising chickens, pigs, sheep and goats, which is also a function of science, will facilitate additional sources of meat.

Fish is an important source of food and protein. There is no doubt about the importance of increasing local fish supplies. The development of inland fisheries by the construction of fish ponds, the training of staff in fish culture, and the performance of experiments in the artificial production of indigenous fish should be carried out extensively. Here again the importance of science in accomplishing the task cannot be overemphasized.

It is unfortunate that only a small portion of Nigeria's forest land has been of real economic value. Trees have been cut down indiscriminately and forest fires have destroyed many trees. The method of farming described earlier has not helped because every year forests

⁴Trade Directory of the Federal Republic of Nigeria 1963-64 (London: Diplomatic Press and Publishing Company), p. 36.

are cleared and burnt as the farmers continue their method of shifting cultivation. Soil erosion also has caused considerable damage in many places. Many animals have not been protected by laws and so these animals live at the mercy of the hunters. Wildlife management is not practiced in many sections of the country and still awaits complete national acceptance.

Science and technology will no doubt contribute to changing the existing condition to a more satisfactory one. Some of the functions of science and technology in doing this will include the introduction of some species of general utility timber such as Afromosia elata, planting more useful trees to take the place of those that have been removed, undertaking projects to combat erosion, and instituting a well-planned and executed conservation program in which wildlife conservation and management should be included. In this endeavor public cooperation is of paramount importance. Odum and Odum have expressed the essence of conservation of natural resources thus:

The aim of good conservation is to insure a continuous yield of useful plants, animals, and materials, by establishing a balanced cycle of harvest and renewal. . . . Probably the most important job in conservation for the immediate future is to establish the fact in the minds of the general public that man is a part of a complex environment which must be studied, treated, and modified as a whole and not on the basis of isolated "projects."⁵

⁵Eugene P. Odum and Howard T. Odum, Fundamentals of Ecology (2nd ed.; Philadelphia and London: W. B. Saunders Company, 1959), pp. 421-422.

The importance of education in speeding up agricultural development cannot be neglected. As the Education and World Affairs Committee has pointed out:

The question of the present educational level of Nigeria's agricultural human resources can be quickly answered: very few farmers have any formal education at all. . . . The bulk of the labour supply for agricultural development exists in situ, but it is not sufficiently prepared to develop the economy. This labour must be transformed into a more highly productive, change-oriented body by means of the transmittal of certain knowledge, skills and techniques. The farmer must first acquire a foundation of general knowledge to enable him to develop skills and techniques to increase production and his standard of living.⁶

Food and Nutrition

About three-quarters of the area under cultivation in Nigeria is devoted to crops grown for local consumption, and most of the remainder yields crops that are important locally as well as for export.⁷ Root crops are produced in the South, and the main staples are yams, cassava, cocoyam, maize, some fruits and vegetables. In the grain-producing North, the staples are guinea corn, millet, maize, rice, and some meat.

The problem of malnutrition or food deficiency exists in Nigeria. It does not lie so much in the quantity

⁶ Education and World Affairs Committee on Education and Human Resource Development, Analysis of Human Resource Development and Utilization in Nigeria, New York, 1967, pp. 72-73.

⁷ The Royal Institute of International Affairs, op. cit., p. 91.

of food being available but rather in the lack of balance in the diet. Food habits, tradition, and ignorance work against balanced diet and ultimately bring about malnutrition. Fowls are found all over Nigeria, but eggs do not form an important part of the diet of the people.⁸ Milk and meat are regarded as luxuries which only the wealthy can afford.

Dietary deficiency has caused many problems and ailments to the people of Nigeria. Nicol made a study of nutrition in northern Nigeria, and has reported that the diet of the people was deficient in vitamin A, riboflavin and nicotinic acid, resulting in diseases such as follicular hyperkeratosis, elephant skin, night blindness, angular stomatitis, nasolabial serborrhoea, and gross liver damage.⁹

Nicol has also studied the problem of nutrition in southern Nigeria and has reported that there were deficiencies of vitamin A, riboflavin, aneurin, nicotinic acid and B-complex vitamins in the diet of the people resulting in diseases such as follicular hyperkeratosis, elephant skin, dyspepsia, lesions of the tongue and undue proneness

⁸Trade Directory of the Federal Republic of Nigeria, 1963-64, op. cit., p. 40.

⁹B. M. Nicol, "The Nutrition of Nigerian Peasant Farmers, with Special Reference to the Effects of Vitamin A and Riboflavin Deficiency," British Journal of Nutrition, III (1949), 41.

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to fatigue.¹⁰ The existence of vitamin D deficiency has brought about the occurrence of rickets, according to Jelliffe. He has pointed out that it seems likely that this could be easily and adequately prevented if the children could be weaned at an earlier age on to a balanced diet composed of eggs, milk, fish and other things.¹¹

Silvera and Jelliffe,¹² in their findings on liver biopsies in Nigerian children, have stated that fatty infiltration of the liver was found in newborn babies and in infants still breast fed, and that the histological picture was similar to that found in classical malignant malnutrition occurring in older children after weaning. They suggested that maternal malnutrition may be causal factor, and felt that the cases tend to show that latent kwasiorkor may be present in some infants while in apparent good health and while being breast fed. Weaning in this type of case can be regarded as the precipitating factor.

¹⁰B. M. Nicol, "The Nutrition of Nigerian Peasants, with Special Reference to the Effects of Deficiencies of the Vitamin B Complex, Vitamin A and Animal Protein," British Journal of Nutrition, VI (1952), 53-54.

¹¹D. B. Jelliffe, "Clinical Rickets in Ibadan, Nigeria," Journal of Tropical Medicine and Hygiene, XLV, 1 (August, 1951), 119-124.

¹²W. D. Silvera, and D. B. Jelliffe, "Liver Biopsies in Nigerian Children," Journal of Tropical Medicine and Hygiene, LV (April, 1952), 78-79.

Nicol¹³ has stated that malnutrition has contributed to liver disorders in Nigeria, and has noted that up to 19 per cent of the inhabitants of the villages he studied had clinically demonstrable liver disease. In places where the people were well nourished, the figure was 3 per cent. Clinical food consumption surveys done in some northern provinces of Nigeria have shown that in the far north the people lack vitamins A and C due to a low consumption of fresh green or yellow vegetables and fruit, and that children under nine years of age do not get their fair share of food available, owing to the unfortunate practice of farmers overselling staple food crops for cash.¹⁴

From what has been stated, it will be seen that the problem of malnutrition in Nigeria is an acute one with grave consequences. Science and scientific research should investigate the problems involved and attempt to eliminate them. Science programs in all Nigerian schools should include topics on food and nutrition, and simple experiments to illustrate the effects of good nutrition and malnutrition should be carried out. Students should be encouraged to eat balanced diets, and they in turn

¹³Nicol, "The Nutrition of . . . Vitamin A and Animal Protein," op. cit., p. 46.

¹⁴Federation of Nigeria, Annual Report on the Medical Services of the Federal Territory of Lagos for the Year 1957 (Lagos: Federal Government Printer, 1958), p. 29.

should help their families to understand the essence of a balanced diet. There is no doubt that dietary deficiencies should be corrected in order to increase the efficiency of human resources. With this increase will come the development of the economy and general well-being of the people. There is a great need for a change in the poor dietary habits. The increase in the consumption of animal protein will also help to cut down malnutrition. The schools should help the people to understand why they should not over-sell their staple food crops for cash, thereby suffering from malnutrition, and by cooperating with the public, will help to bring about a better understanding about the importance of a well-balanced diet.

Health and Sanitation

From the discussion on food and nutrition, it has been shown that some people in Nigeria suffer from some diseases caused by dietary deficiencies. The basic causes of ill health in the country also include the problems of poverty, ignorance, superstition and apathy. The poor consider the consumption of milk, eggs, and meat as a luxury which they cannot afford. The ignorant do not understand the essence of a mixed or well-balanced diet and do not trust modern medicine. Those chained by superstition attribute the onslaught of any malady to the handwork of an old woman marked down as a witch, or

the evil machinations of a co-worker, or a friend, or even a relative with whom he has quarrelled. Apathy shows its ugliness where the clearing of bush or the filling of a water-collecting ditch in order to destroy the breeding places of mosquitoes is frowned upon. Such are the factors that have created health problems in Nigeria.

The principal diseases in Nigeria include malaria, yellow fever, tuberculosis, leprosy, yaws, sleeping sickness, and onchocerciasis, which causes blindness.¹⁵ Buchanan and Pugh have stated that:

In the case of certain diseases such as malaria and sleeping sickness, it is apparent that the distribution pattern is not entirely a fortuitous one, rather can it be explained in terms of specific climatic and vegetation conditions favorable to the existence of the disease organism or its vector. A general zonation of diseases is, in fact, discernible: thus the Sudan Zone is essentially the zone of epidemic cerebro-spinal meningitis, relapsing fever, undulant fever and louse-borne typhus; the south the zone of yellow fever, malaria, leprosy and filariasis; the disease pattern of the Middle Belt includes both southern and Sudan elements, but is dominated by endemic sleeping sickness.¹⁶

Nigeria still suffers from shortage of medical doctors and other trained medical personnel. The ratio of doctors to population in Nigeria is about 1 to 32,000. Clearly the present number of doctors is entirely inadequate, particularly when it is realized that in many

¹⁵Ibid., p. 20.

¹⁶Buchanan and Pugh, op. cit., p. 55.

areas villages are situated as much as a hundred miles from the nearest medical facility. Disease and injury take a severe toll of life and result in costly losses of labour, time, output and efficiency.¹⁷ There is also a shortage of hospital facilities. In some places the people travel long distances to the nearest hospital for medical care. It is not uncommon to find people dying before reaching the nearest hospital, which may be thirty to forty miles away from their homes. Ambulance service is not available in many villages and since the sick person has to be taken to the hospital by canoe, bicycle or even hammock, his chances of getting to the nearest hospital alive are slim. There is also the added problem of not taking a sick person to the hospital until the person is almost dead. Science and science education can contribute in solving these problems. A good science program will provide a good background for prospective medical doctors, public health workers, nurses and scientists needed to perform the task.

Public health in Nigeria is still plagued by many problems. Infectious and parasitic diseases are still causing serious health problems. Nicol, in discussing the incidence of parasitic infestations in Nigeria has said:

¹⁷Federation of Nigeria, Federal Government Development Programme, 1962-63 (Lagos: Federal Government Printer), p. 37.

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The high rate of intestinal infestations, particularly with hookworms, roundworms and schistosomes, is considered to be a more important factor in the production of anaemia than dietary deficiencies. Distinct from the loss of blood caused by these parasites is the amount of nutriment of which they deprive the host.¹⁸

These diseases sap the energy of the sufferers, and it is reasonable to state that the limited manpower resources that Nigeria has are also being jeopardized. The prevailing state of public health in many communities is mostly the result of poor conditions of simple hygiene and sanitation, created by ignorance, tradition, superstition and apathy. There is a lack of adequate water supply in many places, and the available water supply comes from stagnant pools or ditches dug by the people for collecting rain water. Sewage disposal is simply a nightmare in many communities. The government of Nigeria has stated that the planned development of Lagos as the capital city of the federation embraces the provision, as early as possible, of an adequate water-borne sewage system. The present difficulties in waste disposal in Lagos arise chiefly from the high and increasing density of population, the nature of the soil which makes the use of septic tanks unsatisfactory for both technical and health reasons and the high cost of construction of septic tanks.¹⁹

¹⁸Nicol, "The Nutrition of . . . Vitamin A and Animal Protein," op. cit., p. 47.

¹⁹Federation of Nigeria, Federal . . . 1962-68, op. cit., p. 40.

It can be seen from the above mentioned facts that health and sanitation problems exist in Nigeria. These problems have inevitably affected economic development and the welfare of the people. Science and technology will undoubtedly help in solving some of these problems.

An increase in the number of doctors will help to make medical care available to many people. Concomitant with the increase in the number of doctors, it is essential that there should be an acceleration in the training of nursing staff and public health workers. All of these trained people will help in bringing about the improvement of the existing conditions. A carefully coordinated health program is essential, not only for the physical welfare of the people, but also to contribute to the increased productivity which is essential for developing the country. Scientists and technologists can carry out health campaigns to irradiate harmful insects which transfer pathogens to human beings. They can bring about improvement in water supply, disposal of refuse and sewage, and they can cooperate with the schools in educating the public with regards to good health and sanitation habits. It is important to design a more meaningful program of science education, in which the study of science for the betterment of the society is an important ingredient, so that Nigeria will be able to improve the conditions of her people.



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Industry

The traditional crafts, such as spinning and weaving, and wood-, metal-, and leather-working, play an important part in the life of Nigerians. Modern factory-type industry is still limited. The manufacture of textiles is important but is predominantly a cottage industry. Production on powered looms is confined to a few small enterprises with the important exception of a modern spinning and weaving mill opened in Kaduna in November, 1957. This was designed to turn out about twelve million yards of baft a year. Another notable large-scale enterprise is the cement factory at Nkalagu in the vicinity of Enugu, an area in the eastern section of the country which offers good prospects as a future industrial center.²⁰

The development of industry to broaden the country's economy and improve the standard of living is important, but problems still exist. Nathan Associates, Inc., has described some of the technological problems confronting Nigeria thus:

Many industrial activities are, by the very nature of their nascent economic development, primarily labor intensive. Furthermore, many consumer goods markets are still exceedingly limited or scattered. Substantial mechanization and mass production facilities will be somewhat limited until incomes begin to rise, particularly for farmers who make up three-quarters of the labor force. . . . Apprentices dominate the labor force

²⁰The Royal Institute of International Affairs, op. cit., pp. 108-109.

of most indigenous firms. They are generally unqualified and untrained to operate machines. Even those workers trained at trade schools or centers have, according to many business people, insufficient knowledge of proper production techniques. The larger expatriate firms have for years been operating their own extensive training courses. The indigenous sector is, unfortunately, not financially or technically able to do this. Hire-purchase agreements for machinery usually stipulate a pay-back period of only one to three years, which is exceedingly short for most types of equipment. Such burdensome obligations are beyond the capacity of most indigenous entrepreneurs. Knowledge of preventative maintenance and repair is lacking. A scarcity of properly trained repairmen persists. . . . Some design innovations are occurring but the prevailing tendency is to follow customary patterns used for many years and even for generations. European designs are copied, even though unsuitable to Nigerians needs or climate. Simpler designs could lead to lower costs of production. Furthermore, poorly designed goods usually are inferior and short-lived.²¹

Industrial development is necessary for the development of Nigeria's economy and improvement of life conditions of the people. The functions of science and technology in accomplishing this cannot be overlooked. Machine operators, artisans, laboratory technicians, draughtsmen, surveyors, researchers, chemists, biologists, physicists and engineers will help in making industrial development a reality. Electricity as a source of industrial energy has an important role to play. Large-scale industrialization will depend on an adequate supply of electric power. Therefore, low-cost hydroelectric power should be harnessed from some of the rivers in the country.

²¹Robert R. Nathan Associates, Inc., Indigenous Industry in Nigeria, Washington, D. C., 1964, p. 26.

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Science education occupies a unique position in that a well-organized science curriculum, geared towards meeting the needs of the people, will help in preparing the needed personnel for industrial development.

Manpower Needs

There are some important factors involved in the building of modern nations. Among these are capital, natural resources, foreign aid and international trade, but none is more important than manpower.²² The economic growth of any nation requires the development of human resources. This human resource development is also necessary for the transformation of social and political institutions which a developing nation like Nigeria is seeking.

The requirements for the future economic growth of Nigeria are reasonably clear: first, a very substantial increase in the productivity of agriculture, forestry, and animal husbandry; second, development of mineral resources, particularly petroleum; third, development of air, water, road and rail transport; fourth, substantial industrial growth; and finally, a continued increase in trade and commerce.²³ It goes without saying that for

²²Frederick Harbison and Charles A. Myers, Education, Manpower, and Economic Growth (New York, Toronto, London: McGraw-Hill Book Company, 1964), p. V.

²³Investment in Education, Report of the Commission on Post School Certificate and Higher Education in Nigeria, 1960, p. 51.

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growth to take place in these areas, science and technology will play important roles in providing the personnel qualified to do the work.

In discussing the importance of manpower resources Charleson said,

The task before Nigeria is to move an entire society from its largely traditional base toward desired goals. One of the tools to effect this change is seen as an educational structure to provide high-level manpower skills for some 85,000 individuals.²⁴

The estimates are a formidable challenge to Nigeria's educational system, and according to the Report of the Commission on Post-School Certificate and Higher Education in Nigeria,

About 30,000 of these are described as "senior: managerial, professional, and administrative." Ideally all these should be graduates or the equivalent, and in any case some 20,000 of them must be graduates. This involves an annual flow of at least 2,000 graduates from universities. . . . In addition to the 30,000 men and women with "senior" qualifications no fewer than 50,000 people with "intermediate" qualifications will be needed.²⁵

High-level manpower targets should not be expressed merely in terms of numbers of additional persons required. People are developed after being employed as well as being prepared for employment through formal education. Managers and administrators are built by exposure to the

²⁴W. R. Charleson, Education and Training in the Developing Countries, Elliot, ed. (New York, Washington, London: Frederick A. Praeger, Publishers, 1966), p. 108.

²⁵Investment in Education, op. cit., p. 7.

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light of practical experience and by in-service training. The same is true of engineers, technicians, supervisors and teachers. As a general rule, top positions are filled only with persons who have had extensive experience and on-the-job training in addition to their formal education.²⁶

If the leadership of government and private institutions will give special attention to the management and development of their employed manpower, the quantity and quality of production and service will be improved and employed workers will be trained and available for expanded and new establishments. A genuine effort is required on the part of the schools to reorganize their programs to include such courses in vocational and science education that will make available the knowledge and skills needed for economic development.

Summary

An attempt has been made in this chapter to present the economic conditions of Nigeria, the problems of food and nutrition, health and sanitation, industry and manpower needs. The importance of science and technology in the economy and welfare of the people, and in contributing to the solution of their problems have been enumerated. The task before Nigerian schools is to

²⁶Ibid., p. 65.

reorganize the science education program in order to produce the personnel capable of alleviating human problems and sufferings by using scientific knowledge.

The schools can help in training the technicians needed in such fields as agriculture, industry, and health. This can be done by improving the quality of science education, thereby awakening the latent abilities of the students, kindling and sustaining their interests, so that more students than in the past, can go to universities and qualify as engineers, medical doctors, biologists, chemists, physicists, mathematicians, and public health specialists needed in the country. The schools can disseminate such information to the people that will enable them to appreciate the use of science and technology for public welfare, and be willing to support the programs which will employ scientific knowledge for carrying them out. Science programs should be planned to include activities which will give the students the necessary knowledge and practice for solving social problems. The task is not an easy one, but time is running out, and it must be performed.

CHAPTER IV

EDUCATION IN NIGERIA

If education in Nigeria could tell its own story, in the context of the fact, doubt, apprehension, concern and anticipation about current happenings in the country, it would be a most informative one. The history of Nigerian school system and its borrowings from Britain is not a study of dead issues, for the roots of the present practices lie in the past. Unless one can examine modern practices with some recognition of the historical conditions that created them, one may deal only myopically with professional problems that require clarity of vision.

Historical Background

The Missionary Organization

In the early days of British connection, education in Nigeria was almost wholly in the hands of missionary societies, and although religious training was naturally their first object, they laid the foundations of general education. The Wesleyan Methodist Missionary Society arrived in Nigeria in September, 1842, and started a

mission at Badagry, and built a school. The society built another school at Abeokuta and later established Wesleyan Boys High School at Lagos and a boarding school for girls there. In 1905, a teacher training college, Wesleyan College Ibadan, was founded and since that time many schools have been established by the missionary society.¹

The Church Missionary Society followed the Wesleyan Methodist. The group landed at Badagry and reached Abeokuta in 1846. There they built a church and a school. By 1849 four main stations at Badagry, Lagos, Abeokuta and Ibadan had been established. In 1859 the Church Missionary Society Grammar School was founded at Lagos, and a corresponding school for girls was built ten years later. The Normal College at Oyo for the training of teachers was founded in 1896. The work of the Society had been concentrated in the western part of Nigeria. This was soon followed by the Society's initial contact with the eastern part of the country by a visit to Onitsha in 1857. In 1863 the Church Missionary Society Niger Mission was established at Bonny. The work of the church progressed and in 1904 Awka College for teachers was established. The Church Missionary Society had by 1930 established many schools of various grades.²

¹J. B. C. Okala, "Education and Cultural Dynamics with Particular Reference to an African Kingdom" (unpublished Doctoral dissertation, Columbia University, 1953), p. 102.

²Ibid., pp. 102-103.

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In 1847 the United Free Church of Scotland arrived at Calabar. Many vernacular schools were established and in 1895 the Hope Waddell Institute was founded to undertake trade, vocational and teacher education. There was also a provision for the training of those interested in the ministry.³

The American Southern Baptist Convention began work in 1853 at Oyo. This missionary body founded the Baptist Academy at Lagos, Ogbomosho College for teacher training, and developed a vocational and trades school at Abeokuta. In 1868 the Roman Catholic Mission began work in Lagos. St. Gregory's College was established in Lagos and Christ the King College at Onitsha. St. Thomas College at Igbuzo and St. Charles College at Onitsha were established for the training of teachers. The Qua Iboe Mission, a Northern Ireland Protestant organization, was established in 1887 near Calabar. The Primitive Methodist Missionary Society entered the country from Fernando Po in 1894. This group founded the Methodist College at Uzuakoki, a secondary school and a college for the training of teachers as well. The Girls' School at Ovim was also established by this missionary body. The Basel Mission began work almost at the same time. The Sudan Interior Mission and the Mennonite Brethren in Christ came later and established churches and schools.⁴

³Ibid.

⁴Ibid.

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Pr. cit.

The part played by the Missionary groups in the development of education in Nigeria should be given due acknowledgment. Lewis put it thus:

For nearly half a century the entire educational provision was dependent upon the efforts of the Christian missions supported by their home churches and gifts from friends. Until 1877, apart from passing an Ordinance in 1822, to govern education in all the West African territories, neither the local nor the Imperial government made any provision for education in Nigeria. In 1877 the Lagos administration made grants of £200 (about \$560) to each of the three missionary societies carrying out educational work in the Colony of Lagos. Under the Ordinance a Board of Education was established, consisting of the Governor, the members of the Executive Council, and four nominated members. The general Board had power to set up local boards to advise the general Board on conditions under which grants were made to schools and whether the conditions were being fulfilled, and on the opening of government schools. The Ordinance led to a system of grants-in-aid awarded for good organization and discipline together with special grants based in part on the numbers of pupils enrolled, and, in part, on the results of examinations. In addition, the Ordinance required that the settlement of Lagos should contribute one-third of the salary of Her Majesty's Inspector of Schools for the West African Colonies. The first non-mission school was not founded until 1901, when the Government established a school for Moslem children in Lagos. In 1960 when Nigeria became independent, the mission educational agencies were still responsible for over seventy per cent of the schools in the Western and Eastern parts of Nigeria and the federal territory of Lagos. The advance of education in these parts of the country, and the relative lag in the Northern part, reflect the differential opportunities that Christian missions have had in Nigeria.⁵

Buchanan and Pugh have pointed out that in the North, teaching was largely restricted to the Koranic schools,

⁵⁴Lewis, Society, Schools and Progress in Nigeria, op. cit., pp. 27-28.

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and the agreements reached early in the century between the ruling Emirs and the British excluded Christian Missions from the emirates. The subsequent admission of the Missions into the north has not brought the region educational facilities in any way comparable with those of the eastern and western parts where the educational work by the Missions is of long standing.⁶

Weiler maintains that in the north missionary activities were virtually impossible since the British authorities, in taking over this area, had promised the Emirs not to let Christian missions interfere with the predominantly Islamic societies of the Fulani-Hausa Emirates of the north. Except for the widespread system of Koranic schools, the only educational institutions established in the north before 1920 were, therefore, a few Government schools of rather limited importance.⁷ Lewis has stated that apart from the administrative restrictions upon mission educational effort, there was antagonism towards Western education due to the existence of a loose system of Koranic schools. He has also observed that in the country generally, Western education was identified with evangelization. Whilst this

⁶Buchanan and Pugh, op. cit., p. 233.

⁷Hans N. Weiler, Erziehung und Politik in Nigeria (Gmbh, Freiburg im Breisgau: Verlag Rombach & Co., 1964), p. 107.

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identification inhibited the development of education in northern Nigeria, in the rest of the country it contributed to the growth of a new social group which provided the leadership for the new nationalism of the twentieth century.⁸

The criticism of missionary education in Africa generally, to Lewis, was summed up in 1922 by Dr. Thomas Jesse Jones in the Report of the Phelps-Stokes Commission: "Education in Africa." Jones has been quoted as saying:

Though educational facilities in Africa are largely credited to missions and a really great service has been rendered by them to the native people, many of the missions have yet to realize the full significance of education in the development of the African people. The defects in the educational programme, so far as they exist, have usually been due to their conception of education. Some have thought of education merely as the imparting of information, or, at most, as the development of the mind without relation to the moral and spiritual life. To such a group, education has no religious significance. Others have thought of education as necessary chiefly to enable the Natives to read the Bible and to understand the spirit of Christianity. This group has been content with education in books. For the masses they have provided the three R's. For the catechists and the advanced pupils they have endeavoured to give a knowledge of literature, including, of course, an interpretation of religion. In this limiting education to class-room instruction in books, missionaries were following the ideals prevailing in their home country . . . the missions have failed to see how their success depends on native welfare, and have therefore been strangely indifferent to the economic value of agriculture, and little concerned with the health and morals of the people.⁹

⁸Lewis, Society, Schools and Progress in Nigeria, op. cit., pp. 28-30.

⁹L. J. Lewis, Phelps-Stokes Reports on Education

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Education in British Colonial Policy

The first phase of educational development came to an end in Nigeria, as in all other British African Dependencies with the beginning of Government policy in the field of education dating from the publication of the first memorandum of the Advisory Committee on Native Education in the British Tropical African Dependencies in 1925. Besides being strongly influenced by the reports of the Phelps-Stokes Commission, this new educational policy for Britain's African colonies owed much to the ideas of Lord Lugard, who was highly critical of the educational activities of the missions which, in his view, had contributed greatly to the decline of social discipline and to opposition against traditional authorities. African education, as Lugard saw it, was to create a useful citizen, loyal to his traditional native institutions, and capable of cooperating with a colonial administration that leaned heavily on these traditional structures.¹⁰

One of the first outcomes of the Phelps-Stokes
Report and the Memorandum on Educational Policy in British
Tropical Africa, according to Lewis, was the passing of a

in Africa (London, New York: Oxford University Press,
1962), p. 9.

¹⁰Weiler, op. cit., p. 108.

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new Education Ordinance and Code which became effective on May 26, 1926; the regulations under it became so on September 1, 1927. The provisions were restricted to the Colony and the southern provinces and were directed to the producing of orderly expansion of education. The main provisions included the keeping of a register of teachers; only persons enrolled on the register were to be permitted to teach in the schools in the Colony and the southern provinces. The Governor was given powers to be acted on with the advice of the Director of Education to control the opening of schools and to close schools deemed to be inefficient. Lewis goes on to say that the Board of Education was enlarged to include representatives of all the main bodies concerned with the provision of education in the hope that it would be able to offer advice of real benefit to the Government in the formulation of policy. There was a provision in the Ordinance permitting the voluntary agency schools.¹¹

Towards the end of the 1930's criticism of British educational policy in the colonies came from both the colonial administration itself and the educated Africans in Nigeria. Under the leadership of Azikiwe, Nigerians pointed at the importance in institutions of higher learning in Nigeria that would produce the type of African

¹¹Lewis, Society, Schools and Progress in Nigeria, op. cit., p. 38.

leader required by the idea of a "Renascent Africa." On the other hand, similar voices were being heard in Britain. Of special importance was the publication, in 1938, of Lord Hailey's "African Survey." Hailey set out, though very cautiously, to reconsider the politics of indirect rule, and pointed at the danger resulting from the neglect of the educated Africans, who--in his view--would be the makers of African opinion. Colonial policy in education had to be re-shaped so as to allow future leaders to be trained for their administrative tasks.¹²

Weiler has stated that an evidence of change of British colonial policy with regards to education was given in the Advisory Committee's Memorandum on Mass Education (1944) and the memorandum, published in 1948, on Education for Citizenship in Africa. Both documents were essentially concerned with the educational preparation of the colonial peoples for self-government. The inevitable trend towards autonomy of the colonial dependencies was by now fully realized, and so was the important role education had to play in this process.¹³

The Government and voluntary agencies carried out a certain amount of expansion, particularly in the provision of secondary schools and of teacher training facilities. As Lewis has stated:

¹²Weiler, op. cit., p. 110. ¹³Ibid., p. 111.

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In an attempt to cater for the third stage of education, Yaba Higher College was opened in February, 1932, in temporary quarters in Lagos and moved to permanent quarters in 1934. Courses were provided in medicine, agriculture, engineering and in teacher training at a higher level than was provided elsewhere in Nigeria. Despite the efforts of the government and the sacrifices made by parents and voluntary agencies, the demand for education greatly outstripped the funds available to meet that demand. The demand was not the artificial product of nationalist agitators, nor was it induced by official action on the part of either Government or missionaries. It was, without question, the genuine expression of a people who had come to realize in varying degree that their place in the changing world would be determined by the rate of educational advance and of the application of modern knowledge to their daily affairs.¹⁴

The discontent with the provision of education during this period has been described by Dike, the first African Principal of the University of Ibadan in the following terms:

The Nigerian discontent was concerned not so much with the contents of education. To a great extent the argument as to whether there should be more of industrial and technical than of literary education did not very much concern the majority of Nigerians. The overriding complaint was that there was not enough education--of any kind--for the masses of the people. The key to the understanding of the whole problem of education in Africa is the appreciation of the fact that the whole region thirsts for knowledge. The wealthy and the poor, the aristocrats and the lowest peasants, Christians, Moslems, and the "pagans," cry out for it. Another aspect of the question is the fact that Africans believed, rightly or wrongly, that the kind of education offered under the British Colonial regime prepared them only for subordinate positions in all walks of life. In nationalist balance, therefore, Nigerians were being educated by the British overlords to fill

¹⁴ Lewis, Society, Schools and Progress in Nigeria, op. cit., pp. 41-42.

the role of "hewers of wood and drawers of water." Even when a university institution was founded in the Yaba Higher College, its graduates were rated inferior, in terms of salary and status, to graduates of British universities. Of the first 181 graduates of the college, thirty-eight became either medical, agricultural, or forestry assistants; nineteen graduated as engineers, and six as surveyors. The rest were absorbed into educational, administrative, and technical services as subordinate technicians and clerks. In short, the Yaba Higher College was attacked by Nigerian nationalists on many grounds and was never regarded by them as an adequate answer to their higher educational aspirations.¹⁵

In 1946, a ten-year educational plan was drawn with assistance from the Colonial Development and Welfare Fund. The aim was to provide junior primary education within a generation for all Nigerian children of school age, and make possible a considerable extension of secondary education and teacher training. Though this ten-year plan was superseded by the federal and regional governments' 1955-1960 development programs, the period from 1946 to 1955 was of particular significance for Nigerian educational advance. Despite the fact that the education departments of the northern and southern provinces of the country were united in 1929, legislation continued to be enacted separately until the passing of the Education Ordinance of 1948 which made provision for the whole country. Educational development continued to be inhibited by the hostility of the northern emirs to Christian teaching and Western-type education. In

¹⁵K. O. Dike, "Development of Modern Education in Africa," The One and the Many, ed. by J. N. Brooks (New York: Harper, 1962), cited in L. J. Lewis, Society, Schools and Progress in Nigeria, op. cit., pp. 42-43.

consequence, by 1947 there were still only three secondary schools and just over 1,100 primary schools in northern Nigeria as compared with forty-three secondary schools and nearly 5,000 primary schools in the southern provinces.¹⁶

In order to plan for the type of educational program suitable for an independent Nigeria, a commission was set up by the government. The commission which came to be known as the Ashby Commission was set up in March, 1959, by the federal government to conduct an investigation into Nigeria's needs in the field of post-school certificate and Higher Education over the next twenty years. The report of the Commission entitled, "Investment in Education," has been acclaimed as a model for educational planning throughout Africa. The Commissioners' report was based on the gratifying assumption that by 1980 Nigeria should be a giant nation of some fifty million people and unless a new educational system replaced the present one Nigerians would never be able to produce their own talents to man the nation's essential projects. To this end, the Commission recommended that more universities should be built, and more secondary schools with sixth forms should be established as feeders to the universities.

¹⁶Lewis, Society, Schools and Progress in Nigeria, op. cit., p. 44.



The educational policy of the British Government in Nigeria cannot be divorced from the total policy of colonial administration. Ikejiani has stated that the policy was based on: (1) organization of education for various kinds of pupils, but not at all based on individual differences and equal opportunity, (2) a great emphasis on use of voluntary agencies--the missions--who thus continue their emphasis on religious education, to which the policy gave a prominent place, (3) use of a large number of expatriate staff, (4) central control of education where the climax of educational produce was employment in government service, (5) use of external certificates as the basis of government employment. This policy has brought many problems to education in Nigeria. The schools have conformed very closely to British model.¹⁷

In describing the policy and practice, Ikejiani has said:

The educational policy and practice have been conservative and based on class structure. The idea has been to educate a few who snub others not of their type. The whole attitude of the nation toward labour derives from this gentleman's education of the administrative elite destined, under the British education system, to be the repository of ideas that keep the nation going. This philosophy of education naturally reflects the philosophy of educated gentlemen, the refined elite. This does not, of course, mean the whole people of a whole

¹⁷O. Ikejiani, Nigerian Education (Bristol, England: Longmans of Nigeria, Ltd., Western Printing Services, 1964), p. 7.

country, but that select group, of like mind, who form the cream of society, leaders necessarily chosen and trained for the purpose and not a spontaneous outgrowth of a whole people participating in their attempt to solve their country's problems.¹⁸

This is the Nigerian dilemma, and Hanson has summarized it by stating that the true cost of such conceptions of education is not to be counted in the money spent, but in the unnumbered graves still being filled by tribal strife, in the frustration and tensions of lives dwarfed by every form of impoverishment, in elites that vaunt their education rather than serve their people, in minds that imitate rather than liberate.¹⁹ Such are the facts which have formed the crucial issues in Nigerian education.

Structure and Organization

Nigeria before 1967 was divided into northern, eastern, mid-western and western regions, and the federal territory of Lagos, for administrative purposes. Each of these areas had a Ministry of Education headed by the Minister of Education who was a Nigerian politician. The posts of the Permanent Secretaries, responsible for the administrative organization of the ministries, were also

¹⁸Ibid., p. 9.

¹⁹J. Hanson, Imagination and Hallucination in African Education (East Lansing, Michigan: Institute of International Education, Michigan State University, 1965), p. 2.

held by Nigerians. Inspectors or advisors on primary and secondary education, teacher training, women's education and technical education were responsible through the Permanent Secretaries to the Ministers for the professional function of the ministries.

In spite of the fact that there were regional variations, the general pattern of education in Nigeria represented one type of British education that had been developed overseas. Weaver has described it thus:

The educational programme in Nigeria is cast in the mould of the best of British education. All of the rituals, conventions, administrative and organizational paraphernalia of much of British education are there, but they must operate in a different zeitgeist, on another level, and in other dimensions. For the British introduced their system of literary and humanistic education to a people who were already ancient; a people who had, somehow, remained outside the impact of that series of scientific, technological, and intellectual revolutions which so affected and characterized much Western European oriented nations after the sixteenth century. Hence, the British sought to bring education to a people who were, to the British, ignorant, illiterate, indolent, pagan, and isolated from the mainstream of contemporary civilizations. The philosophy and purpose of the British was at once utilitarian and religious. The basic objective was stated in terms of the need to "Europeanize" and "Christianize" the natives. The first task was to provide the natives with a set of knowledges and informations (cognitive structure), a set of beliefs and values (affective states), and a series of behaviours (psychomotor) which would enable the natives to assume proper postures befitting colonials, and to play the roles and assume the functions which the expatriates could or would not play and assume. The desire was to produce, and as quickly as possible, enough literacy for the natives to operate as servants, messengers, semi-skilled workers, clerks, and in the civil service posts which Africans could aspire to. British text books were rewritten

into Tropical or West African and stress was placed upon natives obtaining the necessary literacy, certificates, and/or degrees and other credentials which became the tokens and sesame for posting and employment.²⁰

In describing the problems of Nigerian education Moore has stated, "Curriculum-wise, the biggest problem is to supplant the British pattern of courses intended to produce clerks and colonial civil servants with the concept of community-school, Nigerian-style."²¹ Bunting has commented on the pattern of secondary education in Nigeria by saying that:

For many years the main trend of secondary education in Nigeria has followed the pattern of secondary education in England. In consequence, as in England, the secondary school curriculum has for many years been highly academic in nature and largely controlled by the requirements of examinations set in England. The resemblance has been noticeable, too, in out-of-class activities, which have for many years consisted mainly of team games, often compulsory, and the house system, also imitated from the English boarding schools, has centered almost exclusively around internal competition in these games. The perfect system is another example of the influence of the English tradition, and very often we in Nigeria have been content with these posts as practically the only ones providing opportunities for responsibility, confined though they have usually been to the Senior members of the highest class in the school. . . . There is, however, a danger which all of us who are concerned with education in Nigeria today might pause to consider. The pattern of the past is not always the best blueprint for the future.

²⁰Edward K. Weaver, "Science Education in Nigeria," Science Education, XLVII, 4 (October, 1964), 351.

²¹Hollis A. Moore, "Nigeria Looks to Schools to Better Living Conditions," The Nations Schools, LIII, 3 (March, 1954), 74.

Changing needs often require changing treatment to satisfy them. In the field of medicine, newly identified diseases demand further research and familiar ailments receive new treatment. In the field of education, the demands of the twentieth century cannot be entirely met by the methods of the nineteenth century, and most important of all for us, Nigeria today may not always be served best by an approach to education which is based exclusively on what was fashionable elsewhere years ago.²²

Basically, the educational system was structured on a six-to-eight-year primary school program. Secondary education consisted of a five-or-six-year course to qualify for university entrance examinations. Teacher training colleges had opportunities for students aspiring to secondary level qualifications or higher. Agricultural education tended to be less prestigious, but entrants to these schools (as was true of many admitted to teacher training colleges), had been primarily seeking a higher qualification.

Primary Education

Education in Nigeria has not been compulsory, but it was made free in Western Nigeria in 1955 for children within the 6-12 year age group, and the federal capital of Lagos likewise made primary education free in 1957. In the same year, a similar scheme was introduced in Eastern Nigeria, but it was later modified owing to the

²²J. R. Bunting, "Tradition and Innovation in Secondary Education," West African Journal of Education, V, 2 (June, 1961), 41-42.

high cost involved. Expenditure on education in Eastern Nigeria rose to about 45 per cent of the region's total expenditure. In the financial year 1960-61, the government devoted 45.6 per cent of total expenditure to education.²³ Therefore, the government of the region decided that fees should be paid by the pupils. The former universal eight-year primary course is not used in the federal territory. It became a seven-year course in the Eastern region, a six-year course in the Western region, and in the Northern region a four-year junior primary school plus a three-year senior primary course. Table 1 shows the numbers of primary schools and pupils by regions and controlling authorities from 1958-1962. There are about 17,000 primary schools attended by more than two and a half million children by 1961.²⁴ The government of the Eastern region by 1963 was spending 48 per cent of its income on education, the Western region 45 per cent, and the Northern region 27 per cent.²⁵

The primary school curriculum usually includes handwriting, religious knowledge, arithmetic, health, physical education, nature study, gardening, singing, history,

²³British Information Services, op. cit., p. 23.

²⁴Federal Nigeria Independence Supplement, Nigeria, 1961, p. 6.

²⁵Foreign Education Digest, (January-March, 1963), 224-228.



TABLE 1.--Primary education. Number of schools and pupils, by controlling authority, 1958-1962.*

Year	North		East		West		Lagos		Nigeria	
	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils
Government Schools										
1958	3	293	11	3,075	7	1,415	1	992	20	5,768
1959	4	287	11	2,659	7	2,208	1	640	24	5,714
1960	7	849	11	3,242	7	1,963	1	717	24	5,700
1961	(2)	279	11	3,577	7	2,200	1	717	24	5,697
1962	--	--	11	2,826	7	1,826	1	1,111	24	5,514
Local Authority Schools										
1958	514	75,585	1,761	147,487	1,761	241,120	1	604	2,747	42,534
1959	744	122,202	1,776	152,261	1,776	215,217	1	604	2,747	42,534
1960	584	143,451	1,776	152,261	1,776	215,217	1	604	2,747	42,534
1961	(923)	191,919	1,776	152,261	1,776	215,217	1	604	2,747	42,534
1962	1,251	149,632	1,776	152,261	1,776	215,217	1	604	2,747	42,534
Municipal Schools										
1958	942	123,638	4,791	1,116,187	4,791	831,891	13	51,813	10,823	2,072,574
1959	1,027	123,274	4,803	1,116,187	4,803	831,891	13	51,813	10,823	2,072,574
1960	1,256	143,707	4,803	1,116,187	4,803	831,891	13	51,813	10,823	2,072,574
1961	(1,163)	161,519	5,218	1,116,187	5,218	831,891	13	51,813	10,823	2,072,574
1962	1,063	192,196	4,752	1,116,187	4,752	831,891	13	51,813	10,823	2,072,574
Unified Schools										
1958	325	24,463	50	1,714	--	--	21	4,752	503	33,493
1959	515	32,129	52	1,714	--	--	16	3,846	503	33,493
1960	473	41,191	115	7,013	--	--	13	3,846	503	33,493
1961	(491)	52,577	103	7,013	--	--	13	3,846	503	33,493
1962	254	18,566	57	5,715	--	--	13	4,546	503	33,493
All Schools										
1958	2,206	229,164	6,620	1,821,112	6,620	1,037,377	99	56,688	15,523	2,544,701
1959	2,340	250,912	6,652	1,821,112	6,652	1,037,377	103	56,688	15,523	2,544,701
1960	2,605	282,648	6,451	1,821,112	6,451	1,037,377	112	74,465	15,523	2,544,701
1961	(2,534)	316,264	7,023	1,821,112	7,023	1,037,377	117	81,790	15,523	2,544,701
1962	2,563	353,934	6,473	1,821,112	6,473	1,037,377	120	95,511	15,523	2,544,701

*Source: Hans H. Weiler, Erziehung und Politik in Nigeria (Gmbh, Freiburg im Breisgau: Verlag Romack and Co., 1964, pp. 262-263).

geography, approved vernacular, English language, and handwork. In some areas, civics is included at the primary level, as well as various aspects of domestic science.

According to the Education and World Affairs Committee on Education and Human Resource Development and Utilization in Nigeria, there is gross inefficiency in the primary education system. The quality of instruction at the primary level is very poor. There is very little in the typical primary course which effectively relates the child to what will probably be his life-long environment in the less developed sectors of Nigeria's economy. The Committee goes on to point out that this is partially the fault of the curriculum, the purpose of which is to prepare the lucky few for higher educational levels. Most of the responsibility for the problem lies, however, with inadequate teaching and teaching aids.²⁶

Secondary Education

It has been mentioned that the early missionaries who came to Nigeria from various parts of the world established schools. At the beginning of the twentieth century a few secondary grammar schools and teacher training colleges were in existence, all in the southern

²⁶Education and World Affairs Committee on Education and Human Resource Development, Education and Human Resource Development and Utilization in Nigeria, New York, 1967, pp. 25-26.

part of Nigeria, where the various Christian missions first operated.²⁷

The UNESCO World Survey of Education stated that:

The 1926 Ordinance provided for greater control by the Education Departments and a system of grants-in-aid based on salaries paid to teachers. The Government came into the picture by establishing further secondary schools and introducing elementary training centres for teachers. During the period 1914-29 most development went on in the South but in 1921, in the North, a teacher training college was opened at Katsina, and a number of post-primary schools (12 in 1929), described as 'central,' came into being. These schools very soon acquired the name 'middle' and both South and North Education Departments used the term synonymously with secondary. This was eventually to cause a great deal of confusion as in a full 6-year middle school course the first 2 years corresponded to the last 2 of the primary course, and years 3-6 corresponded to the first 4 of the secondary course. The middle schools of the North were financed largely by Native Administrations and were known as 'NA' schools.

Since 1948 the number of secondary grammar schools has rapidly increased; the West has developed secondary modern schools on a large scale and the North has converted its middle schools to provincial secondary schools. Teacher training colleges also increased in number and settled down into two main categories--elementary (Grade III) and higher elementary (Grade II). The development of secondary education has been closely bound up with that of primary education, and not until the 10-year plan of 1945 did it attract undivided attention. Even then, it did not become the subject of a separate ordinance.²⁸

The secondary grammar schools normally provide a five-year or six-year course leading to the West African School Certificate, the recognized equivalent of the old

²⁷ UNESCO, World Survey of Education, U. K. Territories (West Africa): Federation of Nigeria, 1960, p. 1257.

²⁸ Ibid.

Cambridge School certificate. English is the language of the instruction throughout. Some students take Latin, French or one of the dominant vernaculars. The curriculum includes mathematics, history, geography, English language and literature, physical education and health science. Some schools offer chemistry, biology, general science, physics and religious knowledge. In some girls' schools domestic science is offered up to West African School Certificate standard, and a number take art to the same level. Among subjects not taken for examination purposes are civics, citizenship and music. Table 2 shows the numbers of secondary schools and pupils by regions and controlling authorities from 1958 to 1962.²⁹

The bias of the secondary school towards preparation for higher education has neglected the needs of the majority of students who terminate at the secondary level. Too often the result is to brand them as failures. Most course offerings are so highly academic as to disregard preparation for, and to alienate the student from, work at the middle level or training for intermediate level employment. The Education and World Affairs Committee has described the system thus:

The system does not effectively fill even the needs of the higher education levels, as illustrated by the results of the 1965 West African School Certificate Examination. Only sixty-five per cent

²⁹Weiler, op. cit., p. 280.

TABLE 2.--Secondary education. Number of schools and pupils by controlling authority, 1958-1962.*

Year	North		East		West		Lagos		Nigeria	
	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils
Government Schools										
1958	4	726	4	741	4	1,095	2	508	14	3,070
1959	4	780	4	814	4	1,002	2	591	14	3,177
1960	4	787	4	843	4	995	2	568	14	3,193
1961	5	909	5	1,017	4	1,016	2	644	16	3,586
1962	5	1,113	5	1,280	4	1,072	3	1,075	17	4,540
Local Authority Schools										
1958	15	1,767	6	372	103	17,412	--	--	124	19,551
1959	15	2,030	6	548	131	22,684	--	--	152	25,262
1960	15	2,581	7	773	153	24,643	--	--	175	28,633
1961	16	2,563	8	990	166	29,525	--	--	162	33,073
1962	18	3,227	12	1,339	171	31,494	--	--	201	36,120
Aided Schools										
1958	12	1,593	47	11,037	272	43,981	14	2,561	345	53,172
1959	17	1,881	54	12,021	423	63,174	13	2,890	507	73,656
1960	22	2,836	61	14,003	121	18,074	24	3,780	228	33,753
1961	24	2,835	81	17,336	131	20,984	27	3,941	263	45,148
1962	25	3,535	92	21,230	95	13,165	27	4,559	239	48,489
Unaided Schools										
1958	--	--	42	4,687	--	--	3	1,522	45	6,209
1959	--	--	42	5,343	--	--	3	1,643	45	7,431
1960	--	--	41	6,512	422	57,537	3	1,366	466	65,415
1961	2	180	54	6,505	470	77,226	10	2,517	536	86,428
1962	2	120	98	8,603	585	93,003	14	4,424	699	106,350
All Schools										
1958	31	4,086	99	16,837	379	62,488	19	4,591	528	88,002
1959	36	4,691	106	19,231	558	86,360	18	4,804	718	115,586
1960	41	6,264	113	22,137	700	101,249	29	5,714	893	135,364
1961	47	6,487	148	25,908	763	123,751	39	7,092	997	168,238
1962	50	7,995	207	32,712	855	144,734	44	10,058	1,156	195,499

*Source: Hans H. Weiler, Erziehung und Politik in Nigeria (Gmbh, Freiburg im Breisgau: Verlag Romback and Co., 1964, pp. 264-265).

of those taking the examination passed, of whom only ten per cent passed in Division I, twenty-one per cent in II, and thirty-one per cent in III. Examination results indicate that the system does not provide enough of the natural science instruction required either by higher educational levels or for employment. Of the 32,306 science examinations taken, over half are in health science and biology, which are not demanding and are popular among students with very little instruction in science. The gradual expansion of general secondary education must be accompanied by a greater employment orientation of content and structure to better serve the needs of the terminating student at both the lower and higher secondary levels, and thus to serve the country's need for middle level manpower.³⁰

Sixth Forms

The sixth-form course lasts for a two-year period of more specialized study for pupils who have satisfactorily completed a five-year period of study in a secondary school and have achieved a suitable pass performance at an appropriate external examination, the two-year period of study itself leading to an external examination. In the terminology of the examination system current in Nigeria, this would be expressed as a two-year course of study pursued after the School Certificate examination (or its General Certificate of Education Ordinary level equivalent) by School Certificate holders (or holders of a suitable General Certificate of Education Ordinary level) and leading to the examination

³⁰Education and World Affairs Committee on Education and Human Resource Development, Education, Training, and Employment in Nigeria, New York, 1967, pp. 23-24.

for the Higher School Certificate or its corresponding equivalent at the General Certificate of Education Advanced level.³¹

The Certificate examinations taken at the end of the sixth-form course serve as a prerequisite for entry into universities and some kinds of professional training. The Commission on Post-School Certificate and Higher Education in Nigeria recommended that, in the whole country, there should be some 3,000 sixth-form places a year for pupils who show sufficient academic promise to justify the hopes that they might go on to a university. Of all the schools providing this two-year course, fewer than half have the staff or facilities to offer all the science subjects required.³²

The system of favoring those prepared in the sixth-form over other secondary school graduates seeking admission to university has been questioned seriously. The World Affairs Committee commented on this as follows:

The sixth form gives a university-preparatory bias to secondary schools, the great majority of whose pupils will have to go to work after completing fifth form. Its prestige makes those who do not gain admission feel that they are failures and competes with, and detracts from, other post-secondary institutions which are orientated towards filling critical manpower needs. The sixth form is not able to perform its preparatory role effectively or equitably. Almost half its students who

³¹Investment in Education, op. cit., p. 73.

³²Ibid., pp. 12-14.

sit for the Higher School Certificate examination do not pass at a level sufficient for university admission. Thus many sixth form leavers must terminate their university-oriented education and seek employment without adequate preparation or orientation. Also poor geographical distribution of sixth forms and lack of uniform quality create inequities.³³

In describing the secondary schools, Weaver has stated that:

The schools are either government schools or voluntary agency schools. There are, indeed, more voluntary agency schools than government; but the government heavily subsidizes the voluntary agency schools and maintains the same standards and other regulations for their operation.

Students who enter a secondary school are highly selected. Those who do not have some financial backing either as a scholarship student, or possess sponsorship by a village, or his family or relative, or a friend, are eliminated. Those who do have some financial backing and who apply to the secondary schools must have completed the eight years of elementary schooling or Standard Six, possess the First School Leaving Certificate, or have "read" enough to sit for and pass the secondary school entrance examinations. If successful, they must then survive the exacting and rigorous secondary school entrance examinations which are given in examination centers each year. Those who survive these examinations must then pay their own expenses to the secondary school of their choice for other examinations, and survive the interview--screening examinations there. This process is so tedious and lengthy, and the entrance standards are so high, that in one government college out of the more than 3,000 applicants only 60 are selected each year--more often only 30 applicants will be selected in those secondary schools which do not have two "streams."³⁴

³³Education and World Affairs Committee on Education and Human Resource Development, Education, Training, and Employment in Nigeria, op. cit., pp. 18-19.

³⁴Weaver, op. cit., pp. 355-356.

Other Secondary Schools

Apart from the secondary grammar schools there are secondary technical, secondary commercial and secondary modern schools.

I. The Federal Territory

a. Secondary Technical

- (i) Attached to Yaba Technical Institute--one stream of 25 pupils a year for a four-year course--with a second stream every four years.
- (ii) St. Finbarr's Grammar Technical School--has been taking two streams of 25 pupils a year for a four-year technical course.

b. Secondary Commercial Schools

- (i) Attached to Yaba Technical Institute--one stream of 25 pupils a year for a four-year course.
- (ii) Boys Commercial School--one stream of 30 for a five-year course.
- (iii) Girls Commercial School--one stream of 30 for a five-year course.
- (iv) Mixed Commercial School opened in January, 1961--two streams each of 30 for a five-year course.³⁵

³⁵Federation of Nigeria, Educational Development in Nigeria 1961-70 (Lagos, Nigeria, 1961), pp. 15-16.

II. The Eastern Region

- a. Secondary Technical Schools.--Two government and one voluntary agency. Secondary schools already have the facilities to allow the pupils to present grouped technical subjects at the School Certificate stage. The needs for these schools for buildings and teachers cannot be over-emphasized. There has been a plan for the extension of similar facilities to other schools as soon as possible. The Government Technical Institute at Enugu has operated junior technical courses in engineering and in commerce leading to School Certificate.
- b. Secondary Commercial Schools.--There are seventeen secondary commercial schools with some 3,800 pupils and some 200 staff. They were set up as private ventures to run post-primary courses with a commercial bias. Only two by 1961 were grant-aided but it may well be necessary to assist more of them in the 1960's.³⁶

III. The Western Region

- a. Secondary Modern Schools.--It has been the policy of the Government of the Western

³⁶Ibid., p. 53.

Region that 50 per cent of primary school graduates should be able to enter secondary modern schools for a three-year course. These schools have been charging fees and their future have been under consideration. In 1960, there were some 75,000 pupils attending secondary modern schools--over 31,000 in the first year, nearly 25,000 in the second year and over 19,000 in the third year. The subjects taught in the schools are the usual basic subjects--history, geography, physical education, English, arithmetic, art and crafts, the vernacular language.³⁷ Within the limits set by available funds and staff, an attempt has been made to:

- (i) Make the curriculum distinctively secondary as compared with the primary curriculum.
- (ii) Make the curriculum distinctively practical as compared with the academic grammar schools. The distinctively secondary element appears, of course, in the syllabus of the basic subjects. It also appears in such additional subjects as mathematics, metalwork, commerce and bookkeeping, the library period. These subjects are not

³⁷Ibid., p. 73.



universal as yet and their introduction depends on the availability of staff and equipment. The distinctively practical element shows itself in the compulsory requirement for domestic science in all girls' classes, for expanding woodwork and metalwork facilities for boys, and the attempts to relate the teaching of art and crafts to local traditions.³⁸

Secondary School Leaving Examinations

The West African School Certificates

Examinations for pupils leaving grammar schools have been conducted by the West African Examinations Council (W.A.E.C.) since 1954. The West African School Certificate Examination has replaced the Cambridge School Certificate at the goal towards which students in most of the secondary schools in Nigeria strive; its syllabi largely determine the school curriculum. Papers in it are set and moderated by the Cambridge Local Examinations Syndicate but the actual conduct of the examination, and the setting of a few local papers, such as those in Domestic Science and Cookery, are in the hands of the W. A. E. C. In Nigeria only candidates from schools

³⁸Ibid.



recognized by the W. A. E. C. as having reached a certain standard of efficiency may enter for the examination, and the need for recognition is a powerful incentive to the establishment of reasonable standards of building, equipment and staffing.

According to the regulations of the West African Examinations Council:

The West African School Certificate is taken by almost all boys and girls after five years in secondary schools. The age of candidates ranges from 18 to 20 or over and the great majority leave school after taking the examination. Candidates must take English language and five, six or seven other subjects which have to be chosen from Arts and Science groups to prevent undue specialization. Grades from 1 to 9 are awarded in each subject, grades 1 to 5 inclusive are credit grades equivalent to passes at the Ordinary Level in the General Certificate of Education examination, grades 6 and 7 are pass grades and grades 8 and 9 failures. Candidates are awarded Certificates on the results as a whole and they are placed in one of three Divisions according to their performance in English Language and other subjects. The examination is held at the end of November each year. The award of a school certificate is intended to show that the candidate, in addition to passing an examination, has attended a school which provides a good secondary education in the wider sense of the term. Special recognition is necessary for schools to offer candidates in science subjects. This is to ensure that adequate laboratory facilities are available so that pupils have opportunities for doing practical work.³⁹

³⁹The West African Examinations Council, School Examinations in West Africa, A Statistical Summary, 1959, pp. 1-2.



The Oversea Higher School
Certificate (H. S. C.)

Most Nigerian grammar school pupils leave school at the end of the School Certificate year, and few schools have Sixth Forms yet, so the number of candidates entering for the Higher School Certificate is small. Moreover, a large proportion of the pupils who take this examination have changed their schools before they enter, for it is still the custom for one or two schools in an area to concentrate staff and equipment upon Sixth Form work, and to draw themselves pupils from other schools within their range. Alexander has commented that:

In 1958, 224 school candidates in Nigeria took H. S. C.--only 7 per cent of the pupils who had taken the W. A. S. C. two years previously. Candidates for the H. S. C. examination are required to take a general paper and one to four subjects at principal or subsidiary level. Credit at principal level is equivalent to a pass at G. C. E. Advanced level. The subjects chosen for this examination are quite different from those most popular in the West African School Certificate, and it is obvious that the entrance requirements of the University College and other similar institutions are the factors determining choice. Among boys, the largest numbers of principal subjects entries are in Chemistry (67%), Physics (65%), Botany (42%), and Zoology (40%), the subjects needed for entry to the Faculties of Medicine, Agriculture, Engineering and Science in the Universities. After these come Mathematics (32%), and Further Mathematics (25%), then History (22%). Other Arts subjects taken by at least 10 per cent of the candidates are English (19%), Geography (18%), Economics (14%) and Latin (10%). Bible Knowledge, so popular in the W. A. S. C. examination is taken by only 8% of the candidates.⁴⁰

⁴⁰C. L. H. Alexander, "Secondary School Leaving Examinations in Nigeria," Oversea Education, (April, 1961), pp. 9-10.

Vocational Education

In the Federal territory the Trade Center at Yaba admits about 240 male trainees a year for a three-year post-primary course aimed at producing skilled craftsmen in a variety of trades. They complete their training with two further years in industry. The competition to enter the Center is exceedingly keen. Furthermore, the Center staff requirements for skilled craftsmen with teaching ability are not easy to find. The Center itself runs courses to produce Assistant Technical Instructors, and it will probably be necessary to rely mainly on these and on teachers trained at the new Advanced Training College to produce the new staff needed from time to time. A new trade center for girls has been established by a voluntary agency but this admits only ninety girls a year.⁴¹

Each of the provinces in the Northern Region has a Craft Center which runs a three-year full time residential course for boys. The government has planned to recruit students from the senior primary schools, although there has been also recruitment from junior primary schools. Three of the centers are three-stream (an entry of seventy-five a year) and nine are two-stream (fifty a year). English, mathematics and technical drawing are taught as well

⁴¹Federation of Nigeria, Educational . . . 1961-70, op. cit., pp. 18-19.

as manual subjects at the three Trade Centers situated at Bukuru, Ilorin, and Kano. They have been running courses varying in length between three and five years according to the periods of apprenticeship in different trades and they have mainly accepted senior primary school leavers.⁴²

The principal Trade Center in the Eastern Region is at Enugu. It provides three-year residential courses in ten different trades leading to the Center's own certificate. This is normally followed by two years in industry to complete apprenticeship. Evening classes have been established. There is a provision for a two-year course at advanced level, for Technical Instructors, Precision Fitters and Fitter Machinists to Final City and Guilds standard. A voluntary agency runs a trade center for Fitter Machinists and Carpenter Joiners at Ahiara, near Owerri. Five other Trade Centers operated in the Region either as private venture schools or by industrial firms are the Institute of Radio and Electrical Technology and Shell--B.P. Trade Training School at Port Harcourt, U. A. C. Trade Centre, and Industrial Trade Centre at Awka.⁴³

The Western Regional government schools already have facilities for instruction in handicrafts. The

⁴²Ibid., pp. 34-35.

⁴³Ibid., pp. 54-55.

grants to voluntary agency schools permit some wood and metal work rooms to be provided in those schools which are being expanded or newly built. There are also four handicraft centers financed by the government which between them serve about twenty secondary modern schools. The Government Trade Centres for male trainees run three-year courses in a number of trades for apprentices who have completed courses at secondary modern schools. Most students take Intermediate City and Guilds certificates. There is a Girls' Trade Training Centre at Abeokuta which runs a three-year course in housekeeping and matronship and another in needlework and dressmaking for primary school leavers.⁴⁴

Technical Education

Yaba Technical Institute

Full-time work at Yaba Technical Institute above the secondary technical level is being developed on the basis of sandwich courses. The most common pattern is nine months in college, fifteen months in industry and nine months in college. The courses include City and Guilds Ordinary Certificate work in mechanical and electrical engineering and in building. The great majority of students have been sponsored by public corporations such as the Electricity Corporation and comparatively few by

⁴⁴Ibid., pp. 74-76.

industrial firms. Higher Certificate work will be developed. Part-time day courses have been developed. About 200 students take such courses in technical subjects and about forty in commercial subjects. In addition, some 400 evening students have engaged in one of six years of work leading to the Ordinary Certificate and about 170 students have been taking evening courses in commerce or stenography. About 150 more evening students have been taking other courses.⁴⁵

Kaduna Technical Institute

Efforts have been made at the Kaduna Technical Institute to develop full-time and part-time courses but suitable recruits are few. Courses are offered in electrical engineering, mechanical engineering and building for the Ordinary Certificate. Students take full-time commercial courses which include shorthand, typewriting, bookkeeping, mathematics and some general education.⁴⁶

Enugu Technical Institute

Apart from junior technical and junior commercial courses, the senior full-time work at the Enugu Technical Institute comprised some students in the second year of three-year Ordinary Certificate courses in mechanical engineering, electrical engineering and building, and other students on a promotion course to Assistant

⁴⁵Ibid., p. 86.

⁴⁶Ibid., p. 87.

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Technical Engineer which was not repeated. Shortage of staff and, to a lesser extent, of equipment has interfered with expansion of full-time work. Evening courses have been held in mechanical and electrical engineering, building, commerce and telecommunications, the latter course leading to the new City and Guilds Technician's Certificate in this subject. There have also been preliminary technical courses for primary school leavers, and certain other evening students.⁴⁷

Ibadan Technical Institute

A Technical Institute has been built at Ibadan. The college was planned to accommodate up to 400 students at any one time. Courses lasting for about two years leading to the Ordinary Certificates in building, mechanical engineering and electrical engineering have been offered. Part-time courses for technicians have been planned. The subjects have included telecommunications, radio and television, refrigeration and air conditioning, carpentry and joinery, electrical technician's work, and mechanical engineering and workshop practice. Secretarial courses have been planned for about fifty students a year, half full-time and half part-time.⁴⁸

⁴⁷Ibid.

⁴⁸Ibid., p. 88.

TABLE 1.—*Emigration and Vocational Emigration, 1950-1962.*

Year	North	East	West
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TABLE 3.--Technical and Vocational Schools, 1958-1962.*

Year	North			East			West			Lagos			Nigeria		
	Number of Schools	Pupils	Number of Schools	Number of Schools	Pupils	Number of Schools	Number of Schools	Pupils	Number of Schools	Number of Schools	Pupils	Number of Schools	Number of Schools	Pupils	Number of Schools
Government Schools															
1958	9	965	3	3	375	2	2	259	2	2	1,578	16	16	3,168	
1959	12	1,309	3	3	311	4	4	247	2	2	1,781	21	21	3,648	
1960	14	2,012	3	3	394	4	4	194	2	2	1,955	23	23	4,555	
1961	16	2,401	3	3	694	4	4	454	2	2	1,859	25	25	5,408	
1962	16	2,608	2	2	966	6	6	1,364	2	2	1,998	26	26	6,576	
Local Authority Schools															
1958	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1959	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1960	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1961	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1962	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aided Schools															
1958	--	--	1	1	109	--	--	--	--	--	--	1	1	109	
1959	--	--	1	1	116	--	--	--	--	--	--	1	1	116	
1960	--	--	(1)	(1)	(118)	--	--	--	--	--	--	1	1	(118)	
1961	--	--	1	1	119	--	--	--	--	--	--	1	1	119	
1962	--	--	1	1	138	--	--	--	--	--	--	1	1	138	
Unaided Schools															
1958	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1959	--	--	3	3	301	--	--	--	--	--	--	3	3	301	
1960	--	--	(5)	(5)	(364)	--	--	--	--	--	--	(5)	(5)	(364)	
1961	--	--	5	5	496	--	--	--	--	--	--	5	5	496	
1962	--	--	5	5	527	--	--	--	--	--	--	5	5	527	
All Schools															
1958	9	965	4	4	484	2	2	250	2	2	1,578	17	17	3,277	
1959	12	1,309	7	7	728	2	2	247	2	2	1,781	25	25	4,065	
1960	14	2,012	9	9	876	4	4	194	2	2	1,955	29	29	5,037	
1961	16	2,401	9	9	1,309	4	4	454	2	2	1,859	31	31	6,023	
1962	16	2,608	8	8	1,571	6	6	1,064	2	2	1,998	32	32	7,241	

*Source: Hans H. Weiler, Erziehung und Politik in Nigeria (Gmbh, Freiburg im Breisgau: Verlag Romback and Co, 1964, pp. 266-267).

Teacher Training

The tragic element in Nigerian education is the shortage of trained and qualified teachers. In discussing the magnitude of this issue, Adam has stated that:

Of the total of approximately 93,000 teachers in primary, secondary and teacher training schools, 73 per cent are uncertificated or probationary. Only a few more than one per cent are university graduates. Nearly one and a half per cent are specialist teachers in vocational education. For the primary schools, one per cent are university graduates, but 76 per cent uncertificated. Some 46 per cent of those teaching in teacher training institutions are not qualified to do so. There is an acute shortage of graduate male and female teachers in science, technical subjects, and languages.⁴⁹

Facilities for the training of teachers, whether for academic or for technical institutions, has never been adequate, either quantitatively or qualitatively in Africa. The problem has been aggravated in recent years by the rapidly increasing demand for more and more teachers, especially in the primary schools. The training colleges are consequently sometimes under pressure to produce teachers at almost any cost. Changes in the patterns of training have also had a variety of disruptive consequences.- The question of in-service programs is also very serious.⁵⁰

⁴⁹Samuel C. Adam, "Education and Independence," Phi Delta Kappa, (January, 1960), 162-163.

⁵⁰World Confederation of Organizations of the Teaching Profession, Appendix to the Report of the First Meeting of the Exploratory Commission on Educational Policy for Africa, 1959, p. 9.

The minimum entry requirements are low, and salary scales are not comparable with those of the civil service. There are few promotion possibilities and professional efficiency hardly affects a teacher's career. Many teachers spend considerable time on outside economic pursuits while many leave the profession for other careers.⁵¹

The Commission on Post-School Certificate and Higher Education in Nigeria, in discussing the problems facing the teaching profession in the country, has stated that:

Teaching for many is not a career but a step toward another goal. The result is a constant change of staff which can destroy the continuity of the pupil's education and undermine standards. The following conditions affect professional status: recruitment, admission standards, administration, the inspection system, evaluation and promotion, and conditions of appointment. Programs for Nigerian teachers need far more emphasis on general education. The most striking feature is the low educational qualification of the bulk of its members. Not only do teachers lack professional training but about 90 per cent lack sufficient general education to qualify them. Much more serious are the difficulties of securing enough teachers with sufficient education and of retaining them in the profession.⁵²

Teacher-training institutions in Nigeria were first established by the individual missionary societies to serve the growing number of primary schools under their

⁵¹World Confederation of Organizations of the Teaching Profession, Handbook for Raising Teacher Status in Africa, 1959, p. 61.

⁵²Investment in Education, op. cit., pp. 80-83.

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management. Only in 1926 did the colonial government introduce a register of teachers and teachers' standards. The required standards for teaching in primary schools in 1952 were as follows:

1. Senior primary schools: higher elementary teachers' certificate or Grade II. This required (a) two-year course after Cambridge School Certificate, or (b) two-year course after elementary teachers' certificate, or (c) four-year course after standard VI.
2. Junior primary schools: elementary teachers' certificate or Grade III. This required a two-year course after standard VI.⁵³

Callaway and Musone have discussed the organization of teacher training thus:

In order to maintain as far as possible certain standards, regulations were also introduced as to the proportion of fully qualified teachers for assisted schools. For instance, secondary schools were required to have one graduate teacher for every ninety pupils; senior primary, one-third to one-half of teachers with higher teachers' certificate; and junior primary, one-fifth to one-fourth with elementary teachers' certificate. These regulations, however, could rarely be met and were never applied as a pre-condition for granting assistance. In the South, teacher-training institutions conformed to the above scheme and offered the two-year course leading to the elementary certificate, or both the two-year and four-year courses up to the higher certificate, or only the latter. Some colleges offered also

⁵³A. Callaway, and A. Musone, Financing of Education in Nigeria (UNESCO: International Institute for Educational Planning, 1968), p. 55.

one-year preliminary training for qualification to enter the lower two-year course for those who had failed to pass the entrance test. In the North, there was in addition a lower qualification than the elementary certificate, called Grade IV or vernacular, which was obtained in a two- to four-year course after completion of junior primary school; also, the elementary certificate required a three-year course instead of two. Following a recommendation contained in the Ashby report, four advanced teacher-training colleges were established, one in each region and one in the Federal Territory, offering a three-year course to prospective secondary school teachers of the two lowest forms. Grade II teachers and secondary school graduates were admitted as trainees.⁵⁴

Though the training of teachers was mainly carried out by the missionary societies and other voluntary agencies, the government gave grants to aid the training institutions. Table 4 shows the institutions and number of students from 1958 to 1962.

The problems confronting teacher supply and training in Nigeria have been discussed by the Education and Human Resource Development Committee thus:

The expansion of the Nigerian education system has occurred so rapidly that it has not been possible to staff schools with qualified teachers. The shortage is currently most critical in the primary schools, as suggested by the fact that fewer than one-third of the teachers at this level hold the Grade II Certificate or higher qualification. The far better situation at the secondary level is largely accounted for by the presence of considerable numbers of expatriate teachers, but as secondary schools expand it is doubtful that the supply of such teachers can be correspondingly increased. The Grade II training colleges for primary teachers, which operate at the secondary level but do not prepare for the School Certificate, are in general weak, not least because of

⁵⁴Ibid., pp. 55-56.

TABLE 4.--Teacher Training Institutions, 1958-1962.*

Year	North			East			West			Lagos			Nigeria		
	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools	Pupils	Number of Schools
Government Schools															
1958	20	1,423	5	261	6	535	1	156	1	156	32	2,478			
1959	19	1,466	5	401	8	639	1	154	1	154	31	2,653			
1960	22	1,802	5	456	5	525	1	172	1	172	34	2,979			
1961	16	2,305	4	455	5	455		239		239	28	3,328			
1962	22	3,112	4	455	5	639	2	322	2	322	33	4,552			
Local Authority Schools															
1958	--	--	11	354	29	3,747	--	--	--	--	43	4,601			
1959	--	--	11	1,016	29	3,747	--	--	--	--	33	4,713			
1960	--	--	12	1,356	29	3,747	--	--	--	--	43	4,857			
1961	--	--	12	1,356	29	4,237	--	--	--	--	43	5,198			
1962	--	--	13	1,444	37	4,369	--	--	--	--	43	5,443			
Alien Schools															
1958	27	1,624	126	(9,692)	64	6,486	2	151	2	151	214	17,883			
1959	30	1,739	127	9,557	64	6,595	2	270	2	270	223	18,640			
1960	29	2,310	127	10,002	66	6,955	3	304	3	304	227	19,571			
1961	25	2,334	114	(9,950)	71	7,811	3	234	3	234	213	20,469			
1962	29	3,096	117	9,559	65	8,004	3	414	3	414	214	21,193			
Unaffiliated Schools															
1958	--	--	15	500	--	--	--	--	--	--	15	500			
1959	--	--	15	477	--	--	--	--	--	--	14	477			
1960	--	--	14	501	--	--	--	--	--	--	14	501			
1961	1	76	13	(451)	--	--	--	--	--	--	14	557			
1962	1	112	--	--	--	--	--	--	--	--	1	112			
All Schools															
1958	47	3,047	157	11,337	99	10,471	3	307	3	307	306	24,462			
1959	49	3,254	158	11,765	98	10,771	3	424	3	424	308	26,483			
1960	51	4,112	159	12,013	101	11,307	4	476	4	476	315	27,908			
1961	44	4,668	143	11,987	104	12,306	4	563	4	563	295	29,524			
1962	52	6,320	133	11,160	97	12,954	5	736	5	736	287	31,170			

*Source: Hans H. Weiler, Erziehung und Politik in Nigeria (Gmbh, Freiburg im Breisgau: Verlag Ronback and Co., 1964, pp. 268-269).

inferior staffing. There is a movement towards preparing School Certificate holders for primary school teaching which is educationally admirable but raises the cost-of-salaries problem. The Advanced Teacher Training Colleges, offering three-year post School Certificate programs, leading to the Nigerian Certificate of Education, are well staffed, but their exclusive concern with preparation of teachers for the secondary schools and Grade II teacher colleges is open to question. No institution is as yet providing adequately for the training of school administrators and other educational specialists.⁵⁵

In an attempt to implement some of the recommendations of the Ashby Commission, plans are being made to abolish the lower grades of trained teachers. Many Grade III teacher-training institutions have either been upgraded to Grade II status or closed down.

Higher Education in Nigeria

The resistance of the British government to the pressures for universities in Africa can be traced to three causes, according to Ashby, who described it thus:

First, the pressures were not consistently supported by the Africans themselves. Horton, Blyden, and Hayford were ahead of their time. The great majority of their countrymen were at first indifferent to education; indeed the chiefs and hereditary rulers, protected by the British device of indirect rule, saw in education (and even in incipient African nationalism) a threat to their power. Second, it was British policy to leave education in Africa to the private enterprise of missionaries or to the budgets of colonial governments (the metropolitan government made no grant for education in Nigeria, for instance, until 1940). The colonial governments

⁵⁵Education and World Affairs Committee on Education and Human Resource Development, Analysis of . . . in Nigeria, op. cit.

were too impoverished, and the missionaries too preoccupied with their task of combining schooling with proselytization, to devote funds or time to higher education. Finally there was a sincere conviction on the part of British officials in Whitehall and in Africa that it would be useless to build a university except on the foundation of a sound system of secondary schools--a misguided opinion, for many of the men who held it came from Oxford or Cambridge, universities which flourished centuries before there was a sound system of secondary schools in England.⁵⁶

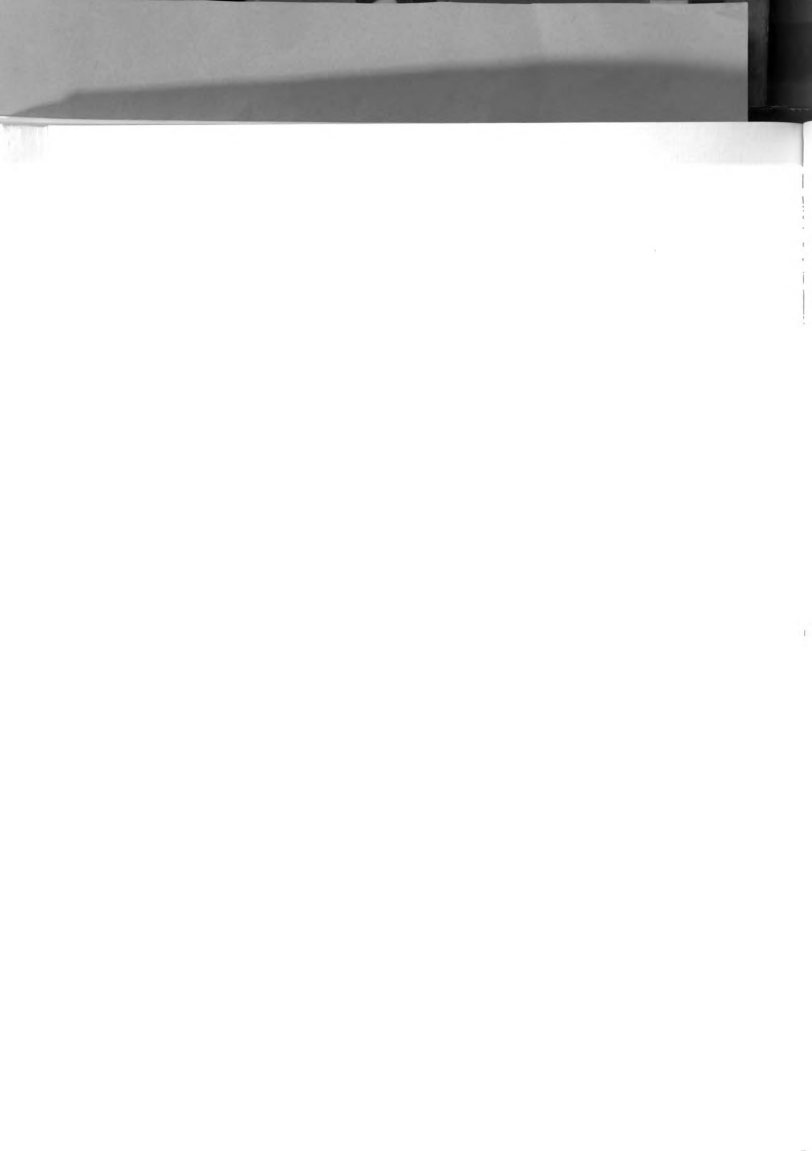
The Higher College, Yaba

In 1934 the government formally opened the Higher College, Yaba, although it had occupied temporary buildings since 1932. The college was, in fact, the beginning of higher education in Nigeria.⁵⁷ It provided courses for students seeking to be Assistant Agricultural, Forestry, Medical, Survey and Veterinary Officers. Provision was also made for the training of engineers and secondary school teachers. The course in engineering was for four years, including two months of practical work each year during the vacations. The medicine course lasted for six and a half years, agriculture for four years, forestry four years, surveying four years, veterinary science seven years and teacher training four years.⁵⁸

⁵⁶Eric Ashby, African Universities and Western Tradition (Cambridge, Massachusetts: Harvard University Press, 1964), p. 15.

⁵⁷Lewis, Society, Schools and Progress in Nigeria, op. cit., pp. 41-42.

⁵⁸O. Ikejiani, Education in Nigeria (New York: Praeger, 1965), pp. 130-131.



Ikejiani has pointed out that in spite of the fact that these courses lasted so long and that the students admitted to Higher College, Yaba, were successful at a secondary school, and that, in addition, the admission into the college was based on a stiff, competitive entrance examination in English, geography, history, chemistry, physics, biology and mathematics, all the college could offer them was a diploma. In addition, the students were not allowed to take the London University external examination, unlike those at Fourah Bay and Achimota Colleges, who were prepared for certain of the examinations of the universities of Durham and London respectively. These irritating circumstances soon aroused agitation for overhauling the Higher College and for the setting up of an institution of true university status. Ikejiani goes on to say that there were also allegations that the number of vacancies in various government departments were a factor reckoned with by the college authorities in determining the number of successful candidates for admission in any one year. This also helped to heighten the agitation and clamour for the establishment of an institution whose academic policy should not be unduly influenced by the whims and caprices of government departments.⁵⁹ All these culminated into

⁵⁹Ibid.

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the establishment of Nigeria's first full fledged university in 1948.

University of Ibadan

The first university institution in Nigeria was established as the University College, Ibadan, in 1948, in special relationship with the University of London. Until the coming into force of the University of Ibadan Act, 1963, the college had power to hold examinations and grant diplomas, but not degrees, to persons who have pursued a course of study approved by the college and to make arrangements with the University of London for students of the college to qualify for and be awarded any of the degrees of that university. The University College Ibadan, therefore, was for all practical purposes a constituent college of the University of London.⁶⁰ According to Weiler, this system of special relation, under which the students at Ibadan used to take London degrees, had had its advantages and its disadvantages; advantages, insofar as high standards were set, disadvantages, as there has not been sufficient regard for local requirements.⁶¹

The University of Ibadan Act, 1963, established as the successor of the University College, Ibadan, the University of Ibadan with the power to award its own

⁶⁰Federal Ministry of Information, op. cit., pp. 6-7.

⁶¹Weiler, op. cit., p. 237.

degrees and diplomas. The university has faculties of arts, science, agriculture, medicine, education and a department of extra-mural studies.

University of Nigeria, Nsukka

The University of Nigeria was established in October, 1960. It is unique in Africa because the recommendation for the establishment of the university was based on the philosophy which animated the enactment of the Morrill Act in 1862, which provided for the broadening of higher education by the founding of land grant colleges in each state of the United States of America, which would be fully equipped to offer courses in such branches of learning as related to agriculture and mechanical arts, without excluding other scientific and classical studies, in order to promote the liberal and practical education of the communities as a whole.⁶²

The government of Eastern Nigeria under the premiership of Dr. Nnamdi Azikiwe in 1955, passed a bill entitled "A Law to Establish a University in the Eastern Region of Nigeria and to Provide for the Guarantee Thereof and for Matters Incidental Thereto." During the course of his speech, Dr. Azikiwe said:

In order that the foundations of Nigerian leadership shall be securely laid, to the end

⁶²Plan for a University of Nigeria, Enugu, 1959,
p. 3.

that this country shall cease to imitate the excrescences of a civilization which is not rooted in African life, I strongly support this bill to the effect that a full-fledged university shall be established in this region without further delay. Such a higher institution of learning should not only be cultural, according to the classical concepts of universities, but it should also be vocational in its objective and Nigerian in content. We should not offer any apologies for making such a progressive move. After all, we must do for ourselves what others hesitate to do for us. . . . I notice that it is envisaged that the university should have six degree-conferring faculties, arts, science, law, theology, engineering and medicine, and I hope that the curricula will be related to the day-to-day life of our people and that they will be so organized as to relate to the mission of the university to the social and economic needs of the region.⁶³

The government decided to direct the Eastern Nigeria Marketing Board to lay aside £500,000 (five hundred thousand pounds) annually from 31 December 1955 to the end of 1964 for supporting the university. This fund by the end of 1964 would amount to a total of £5,000,000 (five million pounds). Michigan State University in East Lansing, Michigan, played an active part in planning and establishing the University of Nigeria, and has continued to provide advisers since the university was opened in 1960. The Enugu campus of the former Nigerian College of Arts, Science, and Technology has been assimilated by the university.

The academic units of the University of Nigeria consist of the following faculties: agriculture, arts,

⁶³Ikejiani, p. 156 (as in Eastern House of Assembly Debates, 18 May 1955).

business administration, education, engineering, law, science, and social studies. Further development has included post graduate studies and a medical school. The university was closed in 1967 because of the civil war between Biafra and Nigeria and remained closed at this time of writing.

Ahmadu Bello University, Zaria

Ahmadu Bello University differs from Ibadan in having been established by the fusion of four autonomous institutions: the former Nigerian College of Arts, Science and Technology at Zaria; the Institute of Administration, Zaria; the Institute of Agricultural Research, Samaru and Abdullahi Bayero College, Kano. Both the Institute of Administration and the Institute of Agricultural Research are semi-autonomous "Special Institutes within the University." The university opened officially in October, 1962.

The Institute of Administration provides courses of instruction for degrees and diplomas of the university as well as specialized vocational training courses for regional government and local government employees. It conducts research, organizes seminars and other activities on a sub-university level. The Institute of Agricultural Research has the primary function of conducting research into matters pertaining to agriculture, with special reference to agriculture in Northern Nigeria. Abdullahi

Bayero College is a constituent college of the university.⁶⁴

University of Ife

The University of Ife opened in October, 1961. The Ibadan campus of the university was transferred to it by the federal government from the former Nigerian College of Arts, Science and Technology. Land was acquired at Ife for the university although the Ibadan branch of the university has functioned since the time it opened. Courses are offered in arts, science and technology, agriculture and law.

University of Lagos

The University of Lagos was established in 1962. A provision was made in the University of Lagos Act for an autonomous medical school within the University of Lagos. Under the University of Lagos Act, on the other hand, there is no faculty of medicine, although Section 1 (i) of Part I of the Act includes medicine as one of the faculties to be established by the university. The Lagos University Medical School is for all purposes an autonomous unit within the university.⁶⁵ The university offers courses in arts, science, education, law, commerce and business administration.

⁶⁴Federal Ministry of Information, University Development in Nigeria, Report of the National Universities Commission, Lagos, 1963, pp. 7-8.

⁶⁵Ibid., p. 8.

Table 5 shows students enrolled in universities by sex and level of course, 1958-1962.

The Problems of Higher Education

The need to adapt the curriculum to the environment cannot be overemphasized. Lewis has pointed out that the universities of Nigeria are not Nigerian universities. They are foreign universities where Nigerians can take good degrees having international currency without knowing anything about Nigeria.⁶⁶

The Education and World Affairs Committee has pointed out that although the situation has been improving in recent years, Nigerian universities continue to be more responsive to the example of certain institutions of higher education in the United Kingdom and other Western countries than to national needs. The resulting overemphasis on narrowly conceived university education has widespread detrimental effects. First, the universities too often tend to keep themselves outside the areas of government interest and activity, although in countries such as Nigeria, the country's developmental efforts are largely in these areas. Thus, the universities' activities may lie outside the developmental process. Second, the narrowly conceived university education promotes a

⁶⁶Lewis, Society, Schools and Progress in Nigeria, op. cit., p. 111.

TABLE 5.--Higher education. Students enrolled in universities by sex and level of course, 1958-1962.*

Year	Non-Degree		Degree		Post-Degree		Total		
	Male	Female	Male	Female	Male	Female	Male	Female	Total
Ahmadu Bello University									
1958	--	--	--	--	--	--	--	--	--
1959	--	--	--	--	--	--	--	--	--
1960	--	--	--	--	--	--	--	--	--
1961	--	--	--	--	--	--	--	--	--
1962	76	3	336	11	--	--	412	14	426
University of Nigeria, Nsukka									
1958	--	--	--	--	--	--	--	--	--
1959	--	--	--	--	--	--	--	--	--
1960	--	--	225	34	--	--	225	34	259
1961	--	--	822	83	--	--	822	83	905
1962	--	--	1,026	122	--	--	1,026	122	1,148
University of Ibadan, Ibadan									
1958	263	23	594	44	15	1	872	68	940
1959	215	15	724	57	10	3	949	75	1,024
1960	212	15	821	60	24	4	1,057	79	1,136
1961	162	35	1,155	98	51	6	1,368	133	1,501
1962	151	32	1,321	108	72	4	1,544	144	1,688
University of Ife, Ibadan									
1958	--	--	--	--	--	--	--	--	--
1959	--	--	--	--	--	--	--	--	--
1960	--	--	--	--	--	--	--	--	--
1961	--	--	--	--	--	--	--	--	--
1962	84	9	138	13	--	--	222	22	244
University of Lagos									
1958	--	--	--	--	--	--	--	--	--
1959	--	--	--	--	--	--	--	--	--
1960	--	--	--	--	--	--	--	--	--
1961	--	--	--	--	--	--	--	--	--
1961	--	--	95	5	--	--	95	5	100

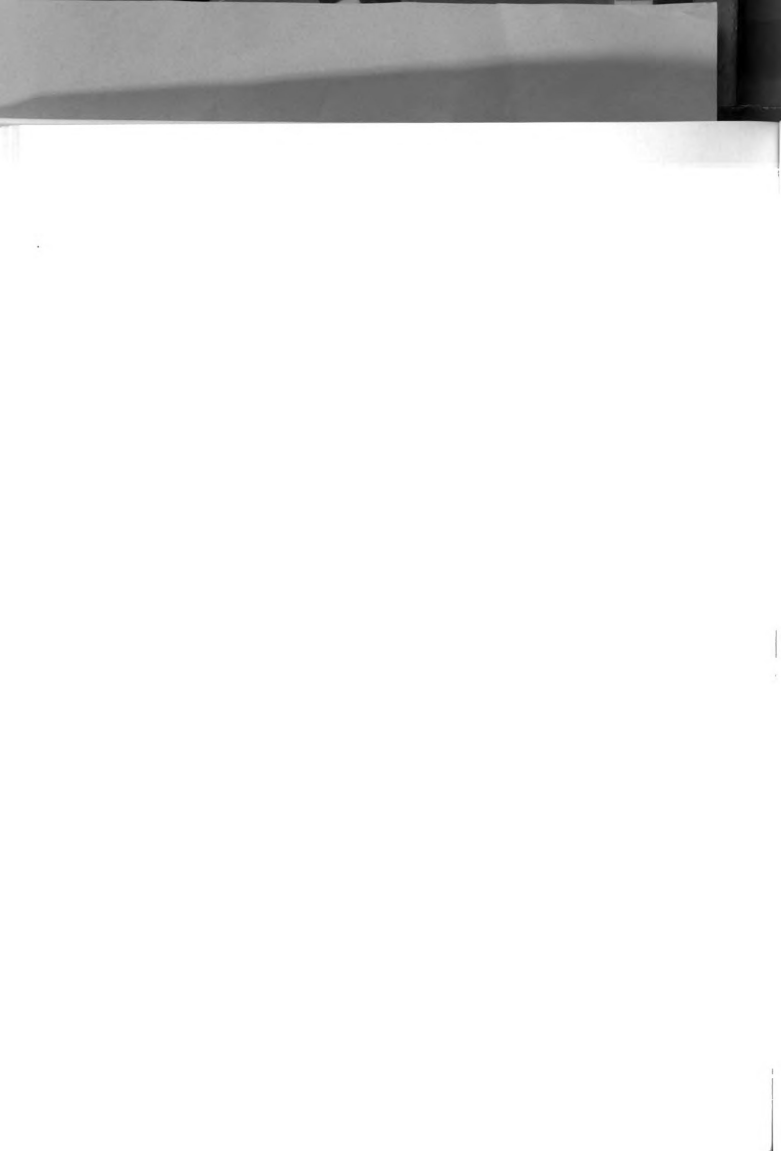
*Source: Hans H. Weiler, Erziehung und Politik in Nigeria (Gmbh, Freiburg im Breisgau: Verlag Romback and Co.), 1964, pp. 276-271.

focus which perpetuates a narrowness and rigidity in sub-university education that is no longer appropriate in the context of the country's developmental needs. Most sub-university institutions focus on university preparation because of the strong drawing power of university matriculation on all students.⁶⁷

There are other problems confronting higher education in Nigeria, and the Education and World Affairs Committee has described them thus:

The extremely high costs of university operation may climb even higher with the increasing tendency to offer post-graduate programs without careful planning and consideration of alternatives, need, or possible duplication. This tendency may perpetuate those problems of misused and under-used university resources which have plagued the expansion of undergraduate facilities. The expansion of undergraduate enrollments beyond planned levels and duplication of facilities continue to divert funds from priority development projects. The higher education system may not be sufficiently related to manpower needs and absorptive capacity of the modern sector. Over half (56 per cent) of the students in Nigerian universities in 1965-66 were in faculties of arts, education, law, and social sciences, with the remaining 44 per cent in faculties of natural science, medicine and pharmacy, technology, agriculture, forestry, and veterinary medicine. This may be an appropriate balance, but it must be emphasized that effective demand for those in the former group of faculties at salary levels hitherto considered to be assured for degree-holders, is becoming satiated. High demand continues for those in the latter faculties because of serious manpower shortages. Although need for both categories of graduates exists, particularly in the education system, absorption

⁶⁷Education and World Affairs Committee, Education, Training, and Employment in Nigeria, op. cit., pp. 16-18.



of those in the first group will probably take place only at lower salary levels. The resulting situation of graduates employed at levels and salaries below their expectations may have serious political and social consequences. At the same time, positions requiring university education in the second group of faculties must go unfilled for lack of graduates.⁶⁸

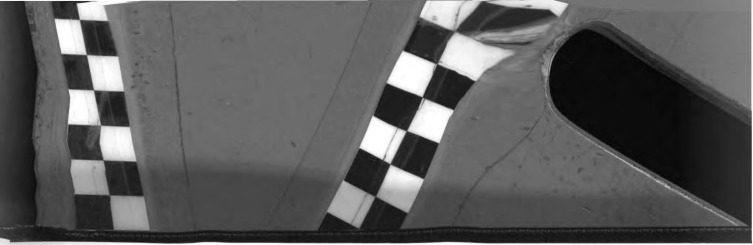
Nigeria still depends on colleges and universities abroad for the training of students in many specialized fields of study and in some fields that the country does not have adequate facilities to offer. This practice will probably continue for more years.

Summary

In this chapter, the historical account of the genesis of what may be called western education in Nigeria and the prevalent educational practices at various levels have been presented. Due acknowledgment must be made of the remarkable role of the Christian missions and voluntary agencies. It is evident as well that the present resources of Nigerian education are insufficient for the task to be performed.

There will always be a place for the more classical and literary subjects, but the trend must be toward the more practical and realistic. Nigeria does not need a purely vocational approach to education at any level, but people must make a living, and the time has already passed in the country when the time-honored classical

⁶⁸ Ibid.



pattern of education will give entry into jobs requiring specific skills.

The curricula of Nigerian schools are currently not completely suited to the background and nature of the people and the economy of the country. Some practices that have no real value that originated in the past should be discarded. It could be argued that these practices were designed to meet the needs at that time, but with the present trends of events, it is safe to say that they have become obsolete. Therefore, there is a great need for a reorganized curricula which will enable the people to develop their economy, improve their health and standard of living, and solve their problems.





CHAPTER V

SCIENCE EDUCATION IN THE ELEMENTARY SCHOOL

The educational system of Nigeria and some of its shortcomings have been discussed in the previous chapter. The weaknesses inherent in the system also affects science education in the schools of the country. The genesis of these weaknesses cannot be overemphasized. Weaver has said:

The British introduced their system of literary and humanistic education to a people who were already ancient; a people who had, somehow, remained outside the impact of that series of scientific, technological, and intellectual revolutions which so affected and characterized much of western European oriented nations after the sixteenth century. The educational system which the Nigerians inherited was one designed to train servants, not masters, and this system did not, indeed was designed not to, prepare the millions of the Nigerian peoples to participate effectively in a world society increasingly affected by the inventions and discoveries of science and the impact of technological improvements. Hence, the major problem confronting the Nigerian people is that of how to overcome their scientific and technological inadequacy.¹

¹Weaver, "Science Education in Nigeria," op. cit. p. 352.

The purpose of this chapter is to discuss the current science education program in Nigerian elementary schools and to point out what has made the program inadequate in meeting the needs of the people and in helping them to solve some of their problems.

The Organization of the Science Program

The Ministry of Education is responsible for preparing the syllabi for the science program, and the standard of the curriculum is maintained by nationally recognized examinations for the School Leaving Certificate for the elementary schools. Because of the lack of science educators, the selection of items in the syllabi has been conditioned in a great measure by the intent to prepare students for their examinations and for entering the universities.

Weaver has stated that science education is practically non-existent in the elementary schools.² He points out that Nigeria must, and, perhaps, for some time to come, depend upon its secondary schools for the mass of its scientists, technologists, technicians, and engineers. What science is taught in the elementary school, Weaver contends, usually consists of infrequent effort to teach nature study, health science, rural

²Ibid., p. 353.



science or agriculture. The Education Ordinance of 1926 included hygiene and nature study in the curriculum for the infant school.³ The Government Syllabus for Elementary Schools, 1931, included among the school subjects hygiene and nature study.⁴ This trend has continued since that time. Apart from hygiene and nature study, there is no science program in the first six or eight years of school in the country. A major factor for this condition rests with the absence of vernacular textbooks in science, for in order to cope with the content of science, the students must first reach an adequate level of comprehension of the English language. This normally does not happen until the students get into the secondary school. McHoney has said,

In Nigeria, science instruction as a separately organized subject does not start before the first form (eighth year) and usually is available only in grammar schools and a few rural schools in the North.⁵

There is, therefore, an urgent need for producing vernacular science books for the elementary grades to enable the pupils to have the basic concepts and knowledge about science commensurate with their grade levels.

³The Education Ordinance, 1926, No. 15, pp. 41-42.

⁴The Government Syllabus for Elementary Schools, Nigeria, 1931, p. 1.

⁵Christopher McHoney, A Survey-Study of Existing Secondary-Grammar School Education in Nigeria in Comparison with the U. S. System, 1961, p. 14.

Course Content

The elementary science curriculum is composed of hygiene or health science and nature study.⁶ As has been mentioned earlier in this chapter, the Ministry of Education is responsible for preparing the syllabi. The syllabi specify the topics for the science program. The teachers and the taught have little opportunity to discuss other topics of interest to them which are not included in the syllabi. The shadow of the public examination which is taken at the end of the grade school career, and which is based on the contents of the syllabi, affords teachers and students little or no opportunity for exploring or discussing other topics which do not appear in the syllabi.

The course in hygiene has several lessons. There are lessons dealing with such good health habits as cleanliness, food, sleep and rest. Lessons on first aid for minor injuries like bruises and cuts are given. There are also lessons on the causes of some diseases, such as dysentery, malaria fever, sleeping sickness, the ailments caused by guinea worm, round and flat worms, and the prevention of these diseases and ailments through personal cleanliness and keeping the homes and surroundings clean. The course includes lessons on water, its characteristics

⁶Ministry of Education, Syllabus for the Primary Schools, 1955.

and methods of purification, and air including respiration and ventilation. The preparation and preservation of foods are discussed.

The topics for discussion in nature study include those dealing with flowers, trees, fruits, vegetable and other farm products, and domestic animals. The lessons on animals deal with comparisons with their feeding habits, defense, reproduction and adaptation to their environments. Lessons are given on birds' feeding habits, variations in beaks, legs, and colors, care of the young, and adaptation to their habitats. The life history of some insects, both useful and harmful ones, such as the butterfly, grasshopper, locust, mosquito and termite is studied. There are discussions on how to get rid of the harmful insects. The discussions on fish include their habits, food, and the different kinds found in the country.

The Methods of Instruction

The content of the syllabi and the examination system have conditioned to a great extent the teaching methods in the science program. The content of some science courses are covered within a specified time only by primary dependence on the lecture method. The teacher, by trying to cover the material designated for the examination at a stipulated time, makes the dissemination of information his prime responsibility. In the elementary

grades there is not much concern or very little occasion, if any, for student experimentation.

The various regional dialects are used for science instruction in the elementary school up to the last two years when English is used. McHoney has pointed out that the science curriculum of the American elementary schools is designed for and directed toward the development of good citizenship, while that of Nigeria is designed for those students who will go on to the university or professional schools.⁷ This is one of the crucial issues in the total educational program of Nigeria. Educational enterprise means more than examinations. According to Lacey and Rowley,⁸ the educational enterprise includes all of those curricular and co-curricular experiences believed to be essential for preparing young people for fruitful lives in a complex technological world. Although that group of formalized experiences commonly referred to as science is only one of the many disciplines that have become a standard part of the enterprise, no other area of knowledge can currently assure quite the unique position of science. Thus, while scientific and technological advances have helped to create many of the

⁷McHoney, op. cit., p. 27.

⁸Archie L. Lacey, and Virginia M. Rowley, Guide to Science Teaching in Secondary Schools (Belmont, California: Wadsworth Publishing Company, Inc., 1966), pp. 3-4.

complexities and problems that confront modern society, solutions of many of mankind's problems have been found through the use of science.

Chaplin has commented about the method of instruction thus:

A survey of nature study as taught in the schools is disappointing. The methods used often contain more than a trace of the less desirable features of the object lesson and teaching is largely, and sometimes exclusively, "verbal." In teaching the names of things and a series of definitions many teachers achieve for their pupils only an increase of mechanical literacy. This may raise their prestige as literates, but it is neither educative nor useful unless the way in which the subject is taught enables them to associate these things, e.g. the parts of a flower, together, and to understand how the whole association of parts works.⁹

Weaver has pointedly said:

The science experiences are memoritor activities, most often unrelated to the everyday life experiences of the children and youth. Since most elementary school teachers have barely completed the elementary school themselves, or may have had one or more years in teacher-training college, they generally lack knowledge about growth and development, how learning takes place, and certainly not trained to teach science in terms of its method, problem-solving techniques, or in terms of the social role and import of science upon society.¹⁰

There is a great need for curriculum reform which will include a reorganization of subject matter, and some

⁹B. H. G. Chaplin, "Elementary Science: A Revised Approach," West African Journal of Education, II, 2 (June, 1958), 68.

¹⁰Weaver, op. cit., p. 353.

fresh approaches to methodology in science teaching. The science instruction should be geared toward enabling the pupils to develop critical thinking and learning problem-solving techniques. The children should be given the opportunity to explore their curiosities and to do things pertaining to science such as exploring the little stream beside their school, or planting their seeds and watching the plants grow. As they do these things, they participate more fully in science studies rather than in memorizing facts given to them by the teacher.

Equipment and Materials for Science Teaching

The equipment and materials for science teaching are inadequate in many elementary schools. There are no laboratories and therefore no laboratory equipment as may be found in many American elementary schools. The blackboard serves as the most important piece of equipment. The teacher draws flowers, plants, insects, animals or other objects on the board and labels them. It does not often occur to some teachers that Nigeria has many plants and animals and that these could be brought into the

classrooms and used for teaching and learning purposes

that children should be taken outside to study them.

The labeling of the parts of the objects drawn on the

board and memorizing these labeled diagrams become more

important than helping the children to learn in a manner



In which they ultimately investigate their environment with increasing competence, enjoyment, and accuracy.

Most elementary schools lack necessary equipment for the demonstration of simple experiments. Lack of funds makes it difficult for many schools to provide the teaching aids needed for science teaching. In some schools there are corners designated for keeping collections of feathers, dead insects, birds, and small animals, some dried fruits and plants, and some models. It is not unusual to find these things locked up in cupboards in some schools, thereby making it difficult for the children to gain easy access to them. Since there are no science textbooks written in the local vernacular, and since the children do not have command of the English language to use textbooks written in English, the only available textbooks are for the teacher's use. Suffice it to state that if all of the facilities are compared with those found in many American schools, one can conclude only that there is much to be desired.

Teachers should make use of all the available resources in the community in which the school is located.

These may include the zoo, farms, markets, streams and lakes. They should work together with the children in constructing simple pieces of apparatus for conducting some experiments such as the propagation of plants from leaves, rate of transpiration, soil erosion, action of pendons, and Foucault pendulum principle.

The Elementary Science Teacher

The teachers who teach science in most elementary schools are also responsible for teaching the other basic subjects. Teachers are grouped as follows:

1. The untrained teacher, who has completed primary education lasting about eight years.
2. The uncertificated teacher, who has the same education as the untrained teacher, and, in addition, two to four years of residence in a training college.
3. The Grade III teacher has the same education as the untrained, two years of residence in a training college plus a pass in the Teachers' Grade III examination taken at the end of the course or subsequently.
4. The Grade II teacher, whose certificate may be achieved in one of four ways:
 - (a) usually by possessing the same educational background as that of the untrained teacher plus four years of residence in a training college and passing the Teachers' Grade II examination,
 - (b) by the Grade III teacher having two more years of residence in a training college and passing the Teachers' Grade II examination,

- (c) by a student who has completed a full secondary grammar school course, two years in a training college and passed the Teachers' Grade II examination,
- (d) very rarely by an untrained teacher of ten or more years of teaching experience who has passed the Teachers' Grade II examination.¹¹ Sometimes the teacher may be awarded the certificate without taking the examination.

5. The Grade I teacher is a Grade II teacher who is selected for a special education course in rural science lasting about a year or two and has passed a written examination and a practical one.

The teachers in the first group are handicapped because of lack of background and knowledge about what they have to teach. Those in the second and third groups are not trained science teachers and do not have sufficient preparation to handle science teaching. The teachers in the fourth group can do a better job than the previous group with strenuous effort. Those in the last group can do a fairly good job considering the circumstances under which they work. Grade I teachers are posted one to a school, but many schools have none.

¹¹McHoney, op. cit., p. 11.

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There is no doubt that Nigeria needs more qualified science teachers in order to improve the science program of every primary school, thereby preparing the children for a more active role in solving both their personal problems and those of their communities and the country as a whole. Chaplin expresses his feelings about teaching and learning in elementary science in West Africa thus:

Science is becoming an ever-increasing factor in life and it is very necessary to give the children in our care the ability to look at life in the orderly and reasoned way demanded by modern conditions of life and government. The starting-point in putting forward a completely fresh approach should not be the stage at which elementary science has evolved from the past nature study course in Europe, or U. S. A. What really is required is just the approach which a well-informed and educated West African would use to give his own child an understanding of the forces and complex structures that comprise his physical environment. As parent and child would join in the adventure of finding out, so should the teacher and the pupil. In this way the teacher would organize the activity of the pupils so as to teach them to discriminate, to select or reject ideas, and to arrive at satisfactory interpretations of the discovered facts.¹²

The Problems of the Elementary Science Program

On the basis of the various studies and suggestions that have been devoted to Nigerian education, it would seem that the following represent the current concerns of elementary science education:

¹² Chaplin, op. cit., p. 70.

1. Whether the objectives of the program should be concerned with developing students' abilities only for passing examinations or should they be concerned with developing students' powers for observation, critical thinking, and problem solving.
2. Whether the syllabi should be rigidly followed, or whether there should be room for the teachers' initiative and students' interests (assuming teacher ability to challenge their interests effectively).
3. Whether the program should remain uniform for all children or whether there should be provisions for individual and environmental differences.
4. Whether the program is enabling the children to develop openmindedness and a willingness to consider new facts and change their minds in the light of new evidence.
5. Whether the present system of examination should be changed or modified to implement a change in the program.
6. Whether the present program is serving the purposes of a desirable elementary science program and if not how it could be modified to meet the needs of the students.

Summary

In this chapter some salient features of the Nigerian science program in the elementary school have been presented, and on the basis of materials examined some conclusion regarding the program can be drawn.

1. The actual objective of the current science program seems to be to hand down facts to the children and prepare them to pass their examinations.
2. The syllabi and the traditional examination system have tended to stifle the initiative of the teachers and the interests of the children.
3. The program does not seem to be sufficiently related to the needs of the students, the community and the nation.
4. The program does not seem to equip the students for problem solving.
5. Full consideration has not been given to the differences in the abilities of the children and the localities where their schools are situated.
6. The program suffers from a lack of adequate staffing of the schools with science educators or teachers with a good background in science and science teaching.



It is proper, therefore, to point to the immediate need for the present science program to be reconstructed in such a way as to serve the needs of children, the community and the nation.



CHAPTER VI

SCIENCE EDUCATION IN THE SECONDARY SCHOOL

The need for a good science program in Nigerian secondary schools is a great one. Nigeria is a developing country, and science and technology will play important roles in this process of development. Weaver has aptly stated that Nigeria must, and perhaps for some time to come, depend upon its secondary schools for the mass of its scientists, technologists, technicians, and engineers.¹ The importance of a good science program has been emphasized in Chapters IV and V. If Nigeria is to cope with its developmental, economic and welfare needs, and be able to solve some of its problems by the use of scientific knowledge, the current secondary school science program must be reorganized. According to Elgood,

It cannot be denied that modern life is dominated by scientific thought and scientific technology. If the new nations of West Africa are to hold their own in this scientific age, it is imperative for them to evolve a system of secondary education that will enable the rising generation to have an adequate appreciation of

¹Weaver, op. cit., p. 353.

scientific principles. For a balanced view this must include the biological as well as the physical sciences.²

In Chapter V it was pointed out that the science education in Nigerian elementary schools is inadequate for helping the people to solve some of their problems and for enabling them to carry out their task of nation-building. The same is true of the science education in the secondary schools. It is, therefore, the purpose of this chapter to present the secondary school science program, and to point out some of the strengths and weaknesses in the program.

The Organization of the Science Program

The Syllabi

In Nigeria the Ministry of Education is in charge of the syllabi for science and other school subjects. McHoney, in discussing the science program, has said,

The standard of the curriculum is established by nationally approved syllabi and is maintained by a series of nationally recognized examinations--the West African School Certificate Examinations, the General Certificate of Education Examinations, and the Higher School Certificate of Cambridge University Examinations. . . . In the U. S., the curricula of most school systems are designed to introduce scientific principles as early as the fifth grade, science as a course of study is taught in most junior high schools, and

²John Elgood, "Secondary School Biology in West Africa," West African Journal of Education, I, 1 (February, 1957), 24.

the curricula of more than 70 per cent of the schools having students enrolled in grades 9 through 12 include provisions for the teaching of the traditional science courses. In Nigeria, science instruction as a separately organized subject does not start before the first form (eighth year) and usually is available only in grammar schools and a few rural schools in the North. Additionally, even good grammar schools offer only certain science subjects to the G. C. E. level, thus a student is rarely exposed to all of the basic sciences at this level.³

As identified in the elementary science program, the selection of items in the syllabi has been conditioned to a great extent for the purpose of preparing the students to pass their examinations. Weaver has pointed out that the science program is designed to enable students to successfully pass the certificate examinations.⁴ The syllabi specify the topics for study, and define the nature and scope of the content. The detailed content is usually carried further in the form of textbooks. In discussing the inadequacy of the syllabi, Morgan states that the science syllabi have been inherited from other regions, often geographically remote and climatically different. He maintains that the biology syllabi of this type will never prove themselves satisfactory for the country acquiring them, unless such syllabi are adapted, or set aside and entirely new programs designed.⁵

³McHoney, op. cit., p. 14. ⁴Weaver, op. cit., p. 356.

⁵D. Morgan, "Modernization of Secondary Level Curricula and the Teaching of Biological Sciences," West African Journal of Education, XI, 1 (February, 1967), 11.

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The West African Examinations Council publishes the syllabi for the West African General Certificate of Education and School Certificate examinations. The University of London publishes the syllabi for the General Certificate of Education examinations, and the University of Cambridge Local Examinations Syndicate publishes the syllabi for the Higher School Certificate examinations.

According to Weaver,

In the syllabuses are specified the nature of the examinations, the time allotted for each paper, and an outline of the specific subject matter, as well as the practical or laboratory work which must be studied and known in order to pass the examination or write the papers.⁶

The Science Curriculum

The problems pervading the whole system of education in Nigeria, some of which have already been mentioned in Chapter IV also plague the science curriculum in the secondary school. The science teachers do not participate in the determination of the objectives and the syllabi; the Ministry of Education prescribes these. The teachers respond by making every effort to cover the materials required for the examinations, because the progress of the students and teachers is measured ultimately by success in the examinations. The infinite concern to pass examination forces the students to be

⁶Weaver, op. cit., pp. 356-357.

more interested in covering the topics of the prescribed content than actually acquiring scientific understandings and getting a good orientation in the use of scientific knowledge for problem-solving. McHoney maintains that:

The American curriculum basically, is directed toward the needs and conditions of the local community and not toward requirements of nationally approved syllabi or examinations, but in Nigeria the curricula are directed mainly toward attaining pass standards in nationally approved examinations. The American science curriculum emphasizes the development of the ability to think critically and to apply knowledge. The Nigerian curriculum stresses the retention and reproduction of facts.⁷

The content of the secondary school science program is in the nature of detached materials which are arranged in topics. The program does not afford the students and even the teachers the opportunity to suggest problems or topics of their choice. Whatever the science which is taken, no matter in what type of secondary school, the simplest procedure to identify course content and teaching procedure is to review the syllabus. For the conventional procedure and program religiously follows the syllabus--and this is regardless of whether the syllabus is sequentially arranged in terms of the relationships of the topics listed for one another.⁸ The students have no other choice but to accept the content of the science program and pass examinations if they are to get the much

⁷McHoney, op. cit., pp. 27-28.

⁸Weaver, op. cit., p. 357.

treasured West African School Certificate at the end of their secondary school career. Naturally, when the materials to be covered are too many in relation to the time allotted for the coverage, and the ultimate road to success is by memorization of content, all acceptable methods and techniques of teaching and learning in science are put in abeyance.

The syllabi for biology, chemistry and physics are shown in the Appendix.

The Methods of Instruction

The content of the syllabi as found in the textbooks, and the examination system have affected to a great extent the teaching methods in the science program. The methods of instruction include writing information on the board while the students copy the information into their notebooks. At times the teacher simply dictates the information and the students take down notes. Traditionally the content of many science courses are covered mainly by lecture method. In his consideration of the time factor, and in his attempt to cover the required material for the required examinations, the teacher makes the dissemination of content his primary responsibility.

The principle of memorizing facts, theories, and laws in order to reproduce them on examinations plays a prominent part in science instruction, just as it does in other school subjects. The methods and techniques

are results of a system in which the passing of examinations has had greater influence than the actual acquisition of usable knowledge. Weaver has described the situation thus:

The rote memoritor and disciplinary nature of the teaching-learning process is of such nature as to generally debilitate and frustrate the development of creative imaginative thinking, or acquisition of understandings, abilities, and insights which are related to the application of what is learned to the solution of everyday problems.⁹

In discussing the methods of science instruction in West Africa, of which Nigeria belongs, Haggis has pointedly said:

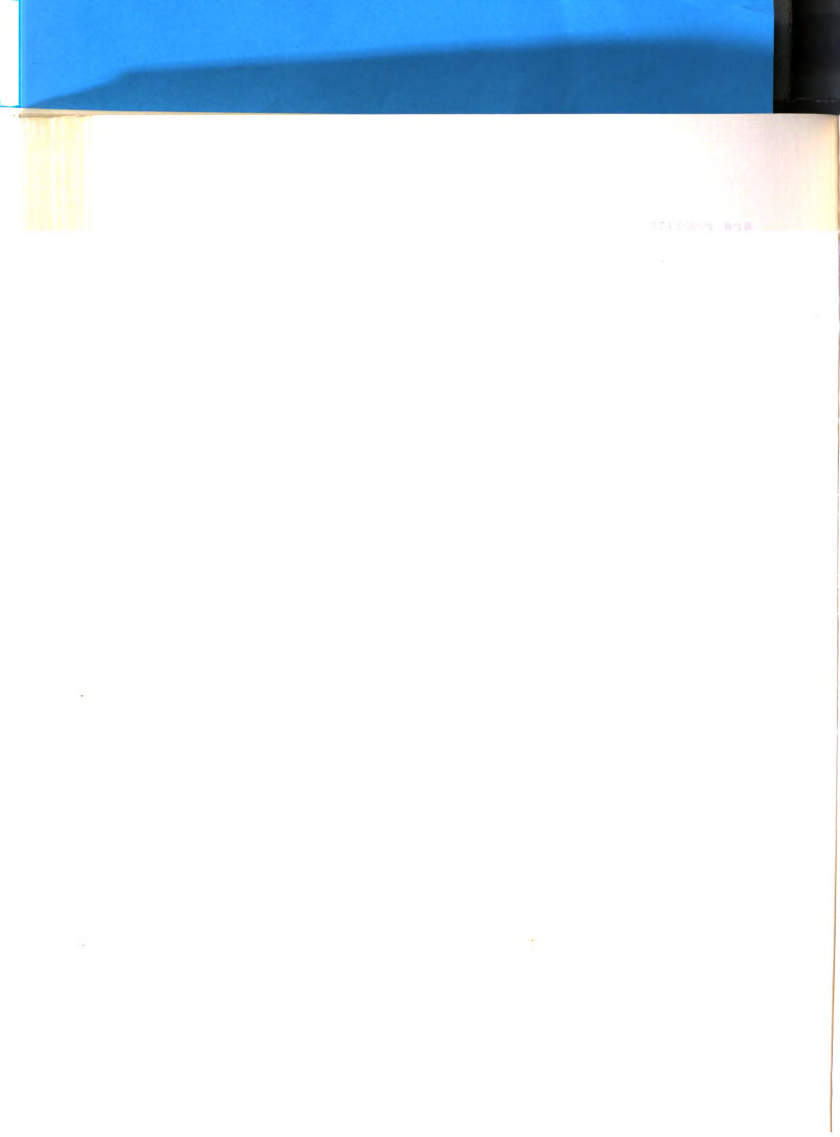
When we examine much of the science teaching in schools in West Africa today, we find that instead of curiosity and wonder dominating a pupil's approach to science the over-riding considerations are more often the 'textbook' or the 'syllabus' and many pupils, after several years of learning science, think of it merely as a collection of facts to be remembered or a series of diagrams to be reproduced. This is no adequate basis for encouraging boys and girls to take up scientific research as a career, nor is it worthy of the name 'science' at all.¹⁰

Morgan has maintained that the present status of biology suffers because:

Students still seem to have an insufficient knowledge of life in the field (or nature in general), their biological knowledge is much restricted to examination types, the syllabus, etc.,

⁹Ibid., p. 353.

¹⁰Sheila M. Haggis, "Original Work in Science Teaching," West African Journal of Education, III, 3 (October, 1959), 102-103.



restricted understanding of applications of biology with the other basic sciences, little knowledge of the history of biology, and a tendency to know more about necrology than biology.¹¹

Wilson has stated that:

School biology in West Africa has been, and still is, largely handled by teachers who on their recruitment often need to study the local flora as quickly as possible if they are not to ignore field studies in their teaching. However much they would teach the basic biology they tend to depend much more than necessary on the text-book. Their students readily illustrate the parts of the ordinary land plant with the balsam plant; they remember clearly the germination stages in wheat because they have been nicely exhibited on the laboratory shelf, or superb attention has been drawn to illustrations in a collection of biological drawings. Thus the local environment is ignored even in the biology, let alone the field aspect of the subject. Granting even that the teacher is fairly familiar with his local flora and is enthusiastic about introducing the students to field studies there is still another factor worth mentioning here. Students are known to be 'syllabus-minded' (so, I am afraid, are a great many teachers) and are not keen to spend time on a study that they know is not merely absent from the syllabus but has not been asked for by examiners for the past ten years or so.¹²

Schumm, in discussing the method of science teaching in Nigeria refers to the letter written by Hibbard, a Peace Corps science teacher in the country, in which he has commented:

¹¹Morgan, op. cit., p. 12.

¹²J. Y. Wilson, "Field Studies in School Biology," West African Journal of Education, III, 1 (February, 1959), 14.

Unfortunately, a lot of science teaching in Nigeria below the fifth form is done by drawing the experiment on the blackboard with chalk. The students copy the diagrams and memorize the scientific principle involved . . . and from these meager beginnings, one tries to let the kids experience scientific discovery. It's a hard job, but somehow we manage.¹³

The practice in some schools is to have science teachers give special attention to student experimentation. These science teachers usually carry a lighter teaching load than those in the elementary schools. Therefore, they have more time to prepare for the experiments. The teachers try to involve their students in the observation of their demonstrations and to carry out some experiments. However, it is not uncommon to find that on many occasions laboratory periods turn into periods of lecturing, owing to the range of content which must be covered before designated dates of examinations.

According to Weaver,

The science laboratory work, or the practicals, tend to be an operation during which the students, under the master's supervision, perform indicated activities in an effort to perform and behave and obtain the 'correct answers,' develop the indicated techniques and skills, formulae, and other requirements which the syllabuses have specified and were called for on previous 'practicals.' Those operations, techniques, skills, and questions which

¹³Ruth Schumm, "Blackboard in the Jungle," The Science Teacher, XXXII, 7 (October, 1965), 40.

have been repeatedly called for tend to become the base for the laboratory work. It is a sad and bewildered master or student that fails to anticipate the questions asked on a practical examination, and when a new practical activity or question appears they tend to feel that, somehow, the syndicate has been unfair.¹⁴

The above mentioned observations cast some light on science education in Nigerian schools. The teaching and learning process of science has affected the attainment of the real purposes of science education, such as the nurture of Nigerian youth in the scientific mode of thinking. There is no doubt that verbalism and memorization of facts cannot in themselves make scientists. Moreover, these techniques do not produce interests and skills conducive to developing scientific attitudes, learnings or even occupational ambitions. The result is that many students leave the schools without having adequate experiences and knowledge about the nature and meaning of science and without adequately familiarizing themselves with the use of scientific knowledge for solving some of their problems, and those of their communities and the country. It goes without saying that good teaching, adequate equipment and materials, and student centered laboratory work can help both the teachers and students significantly in attaining the objectives of a good science program.

¹⁴Weaver, op. cit., p. 357.

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Equipment and Materials
for Science Teaching

Laboratory facilities and equipment vary considerably in the secondary schools. Some schools are better equipped than others. Lack of funds make it difficult for some schools to have the necessary materials and equipment for teaching. In pointing out the discrepancies that exist among schools with regards to teaching materials and equipment, Schumm has stated that Hibbard, a Peace Corps science teacher in Nigeria, in his letter has commented:

Teaching school here is a 24-hour-a-day job, and trying to prepare experiments is the major concern. The chemistry lab has three long wooden tables with wooden stools around them, and into this small room we pack 40 students (half a form) for our classes. There is no water except what we bring in buckets; there are bunsen burners which operate from a portable gas cylinder; we have some balances, a fair supply of chemicals; a blackboard, plenty of chalk, and that's about it.¹⁵

There are charts, models, microscopes, chemicals, projectors and some other teaching aids in the better equipped schools, but on the whole these are not comparable to the equipment and materials found in many American schools. The science program needs many science teachers with skills and ingenuity to tackle the problem of insufficient materials and equipment obtaining in many schools. Teacher and student initiative in constructing

¹⁵Schumm, op. cit., p. 40.

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simple equipment still awaits improvement. Community resources have not been fully utilized, and as Wilson has stated, "It appears that some teachers of biology, while fully aware of the indispensable part that field studies have to play in their teaching, point out that normal time-table arrangements make field work difficult, if not impossible."¹⁶ Taggart has said, "I walked into a classroom and saw a science teacher showing the students some legumes imported from overseas while all around the school leguminous plants were growing in abundance."¹⁷

Morgan, in pointing to the need for using local materials, has stated that:

Biology teaching study-programmes should be seriously considered for each geographic region and territory, irrespective of 'traditions' established through existing syllabuses. Numbers of problems of direct interest to the biologist, and well within the means of secondary school pupils, exist in every part of the world. The stereotyping effect of syllabuses set by 'authority' has, unfortunately, had the tendency to impose a severe restriction upon good teaching, which can be relieved only by a more realistic approach to the problem; if biology is the study of living things then where else can this study be effected than with the organisms in their indigenous habitats. On this very point teachers engaged in secondary schools, university personnel and other science educationists working in various regions should get together to formulate proposals for better teaching of biology involving the efficient and effective use of local materials.¹⁸

¹⁶Wilson, op. cit., p. 12.

¹⁷G. L. Taggart, Vice Chancellor of the University of Nigeria at Nsukka, 1964-1966. The statement was made during his lecture on Education in Nigeria.

¹⁸Morgan, op. cit., p. 10.

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Another statement to substantiate the contention that community resources have not been fully utilized has been made by Brandou, who has commented:

The science teachers were surprised to see that I could get all the materials I needed for my demonstrations just about two blocks away from the lecture hall. The possibility of doing a good job of science teaching exists, but the teachers have to make a maximum use of the resources in the communities in which their schools are located.¹⁹

It is appropriate to include textbooks and other written materials in the list of obstacles to science teaching. As Weaver has observed:

Each student is provided with a textbook or textbooks, with science 'guides' for the practical work, and with numerous notebooks. The textbooks may be used for one, or two, or more years, especially in the first three forms. They have been especially written to enable the student to prepare for the examinations, rather than to cover the area of science studied. If the author or publisher does not specify that the text was written for a particular examination both masters and students tend to not use it. The masters prepare 'outlines' of the term or year's work, and keep 'diaries' of their progress towards achieving the goals of the term and year. Often these are without sequence, interrelationship, and follow the arbitrary listings as stated in the syllabus. If a master wanders too far from the sequence as presented in the syllabus the students (who also have copies of all the previous examinations and the syllabuses) will warn him that he is wasting their time, become uneasy, and openly uncooperative.²⁰

¹⁹J. R. Brandou, Director of Science and Mathematics Center at Michigan State University. He was in Nigeria in summer of 1966 to conduct workshop for science teachers. He communicated the information to the author.

²⁰Weaver, op. cit., p. 357.

There is no doubt that these books reinforce the kind of teaching that has been described because they are more or less systematic rearrangements of the facts and directions prescribed by the syllabi. A mere perusing of most of these books will inevitably induce any science educator to have a strong impression that the vital curiosity and interest of the student is unlikely to be stimulated by them. In describing the inadequacy of the textbooks, Welch has reported that:

It is a recognized difficulty in West Africa that many of the examples of scientific principles given in textbooks lie outside the experience of our pupils. These applications usually assume a knowledge of machinery and gadgets which are not as yet commonly found in this part of the world.²¹

It is the inclusion of things that are abstract and remote from the experiences of the students and things that are abstract and yet the students have to study them in order to pass examinations, that pressures the students into the memorization of principles and facts that have no meaning to them. These are some of the stumbling blocks on the road to a meaningful science education in Nigerian schools.

The problems confronting science education in Nigeria will not vanish soon, and as Schumm has explained:

²¹A. T. Welch, "The Use of the Motor-Vehicle in Illustrating Basic Scientific Principles," West African Journal of Education, II, 2 (1958), 64.

The problems have been compounded by years under the so-called British System. To get a Civil Service job or be accepted by a university, the students must pass the West African School Certificate Examination. This is a standard exam that has been given for years.²²

The young people want to get university education and they also want civil service jobs. In order to pass the examinations, they have to take the shortest avenue leading to success; therefore, memorization becomes the order of the day. Suffice it to state that problems do exist with regards to the shortage of teaching materials and equipment in many schools, and the development of knowledge concerning the best possible use of these aids for effective learning in science.

The Science Teacher in the Secondary School

The science teachers in the secondary schools belong to the following categories:

1. The trained teacher who has completed a full secondary grammar school course, received the West African school Certificate, completed two years in a training college, and passed the Teachers' Grade II examination.
2. The trained teacher who has the West African School Certificate, and has attended the advanced teacher training college for a three-year post school certificate program and passed

²²Schumm, op. cit., p. 41

the Nigerian Certificate of Education examination.

3. The teacher who has the Higher School Certificate or General Certificate of Education (Advanced Level) in science subjects but has no training in education.
4. The graduate teacher with a degree in science but no training in education or pedagogy.
5. The graduate teacher with a degree in science, and has a Diploma in Education or has combined science and education in his degree program.

Nigeria at this time does not have an adequate supply of graduate science teachers for the secondary schools. Some schools do not offer science subjects because of lack of qualified teachers. The advent of the Peace Corps volunteers has been one of the most refreshing things that has happened to education in Nigeria. Some of the volunteers have taught science in Nigerian schools and in some cases they are the only qualified science teachers in their schools. Schumm has written of McDowell, a Peace Corps science teacher, as the first qualified physics instructor at the school he taught.²³ One of the most disturbing situations is that a school may be lucky to get a qualified science teacher, but will not be able to provide adequate laboratory facilities because of lack of funds.

²³Ibid.

The problem of shortage of qualified science teachers is acute and can only be solved by embarking on a well-planned and well-executed program of the training of science teachers.

Problems of the Secondary School
Science Curriculum

The major problems of the science program in the secondary school pose the following questions:

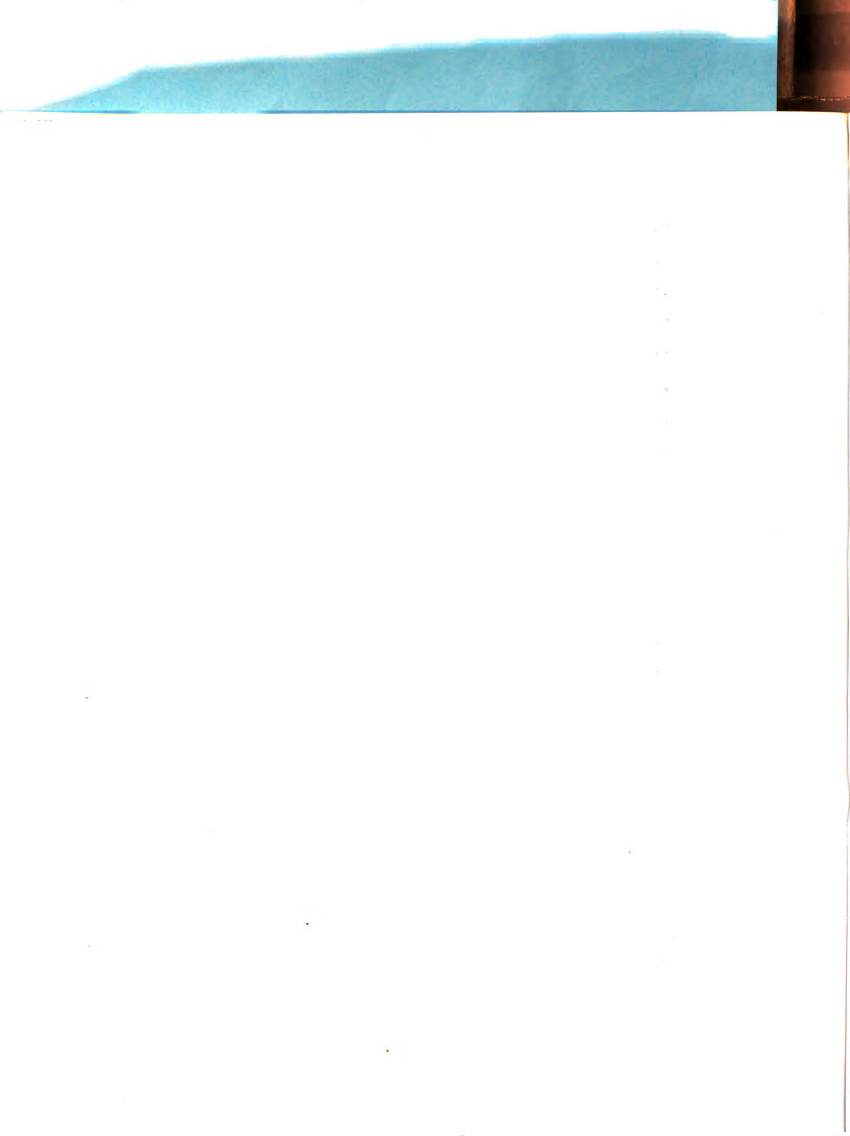
1. Are the objectives of the science curriculum mainly concerned with the development of the abilities of the students for memorizing facts and passing examinations, or are they concerned with the development of individual capacity for observation, critical thinking, and problem solving?
2. Does the present program help to inculcate scientific attitudes and develop competence in the use of scientific methods for problem solving?
3. Should the syllabi be suggestive thereby permitting teachers' initiative and students' interests, or should the syllabi be rigidly followed?
4. Is the program flexible enough to permit differences in student ability and background as well as problems caused by the locations of the schools?

5. Does the program enable the students to develop openmindedness, willingness to accept new facts backed by sufficient proof?
6. Does it foster social and civic responsibility?
7. Is the program helping the students to discard superstitious beliefs?
8. Is the present examination system the best method of evaluating the work of the students?
9. Does the program kindle interest and sustain it long enough to enable many students to enter scientific careers?
10. Does the present program serve the purpose that a good science program should serve in a developing country not advanced in science and technology?

Summary

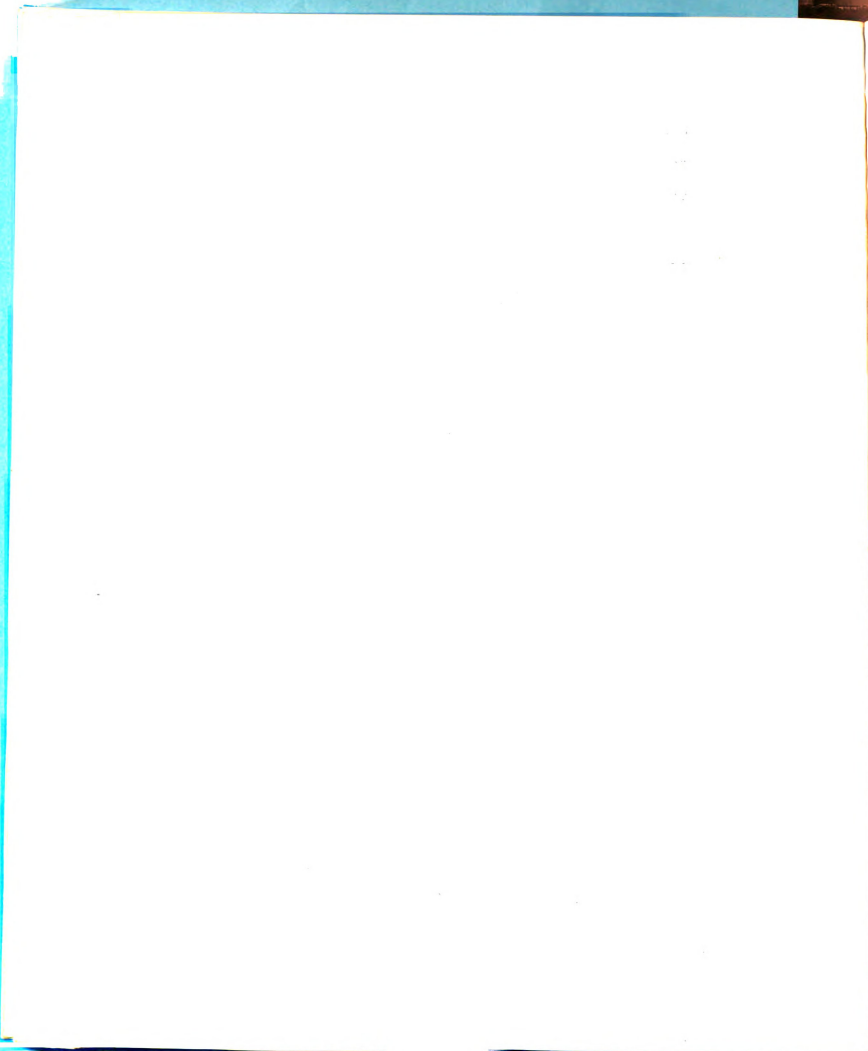
The secondary school science program in Nigeria has been presented in this chapter, and the conclusions may be summarized as follows:

1. The objectives of the science curriculum have been narrow, centered around the dissemination of facts by the teachers, and the memorization of facts by the students in order to pass examinations.
2. The syllabi and the examination system have tended to negate the real purposes of science

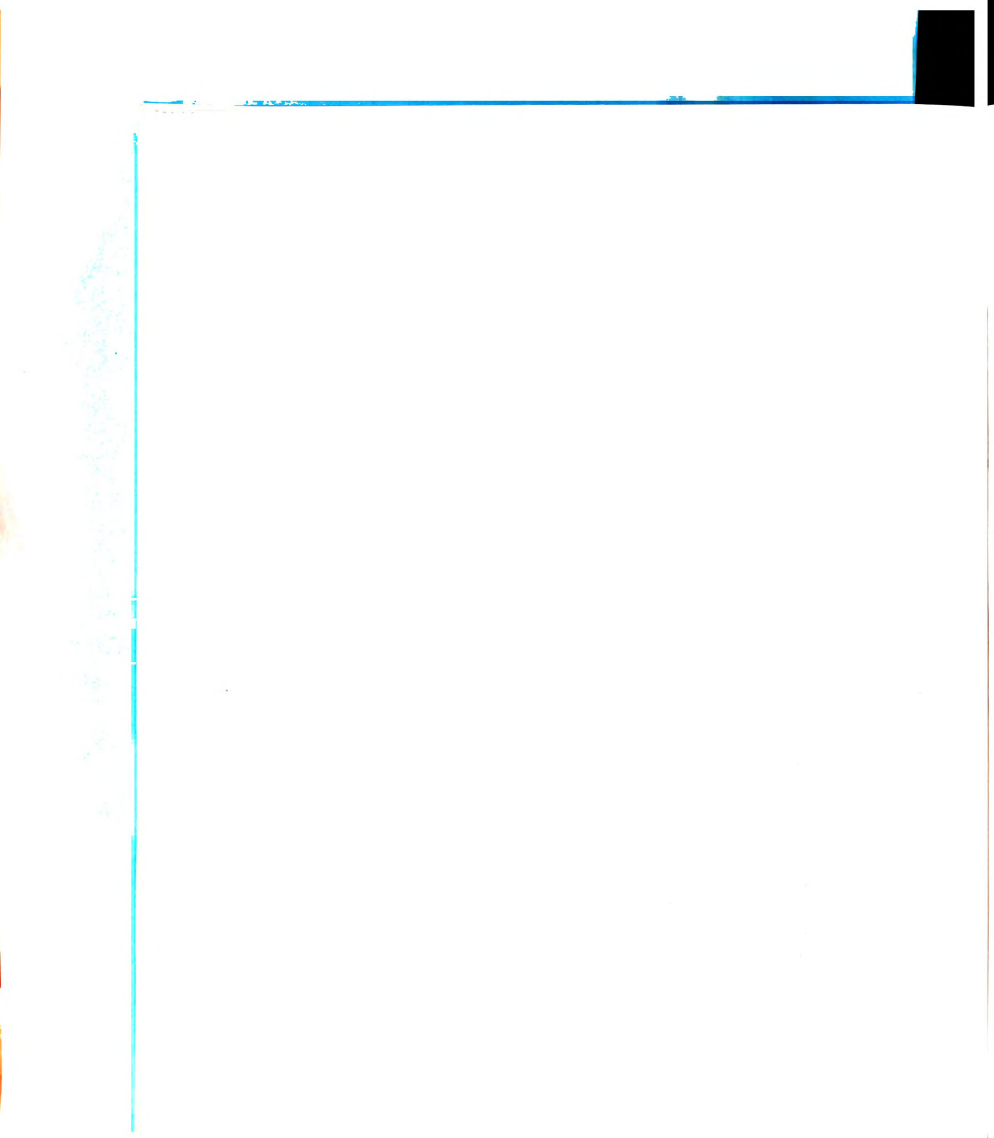


education, and have limited the initiative of the teachers and the interests of the students.

3. The content does not fully reflect life conditions in Nigeria and has not been sufficiently related to the needs of the students. The result is that the students are not well equipped for tackling and solving their problems and those of their communities and nation.
4. The teaching method and inevitably the examination method have tended to make learning in science bookish and perfused by rote memorization.
5. Many schools lack adequate facilities and equipment for science teaching. Laboratory experimentation is mostly devoid of the scientific experience it should give.
6. There is lack of genuine concern for the improvement of societal life through modern science; critical thinking and problem solving techniques have not penetrated deeply into the program so that science graduates are often victims of unfounded superstitious beliefs.
7. The science program is plagued by lack of adequate staffing of the schools with science educators and science teachers with sufficient background in science.



The general outlook of the science education in Nigerian secondary schools leaves much to be desired. With the focus on the developing requirements of a modern nation for technical and skilled personnel, the present circumstances is one that needs an adequate program to perform the task.



CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

The first five chapters of this thesis have investigated the Nigerian society, with regards to its geographical setting, social institutions, government, educational system, and science education program in the schools. The objective was to show the needs of the people of Nigeria and some of the problems that have become an impediment to attaining desired goals. Chapter III dealt with the role of science and technology in the economy and welfare of the people, with some of the problems involved, and with the function of science education in facilitating the potentialities of science and technology in solving these problems.

The objective of this chapter is to make recommendations for reorganizing the program of science education in the schools in the light of the existing program, so that new programs will meet the needs of the people and enable them to solve their problems. The discussion of such reorganization will deal critically and constructively with the various aspects of the science program treated in this thesis. The present science program has shortcomings,

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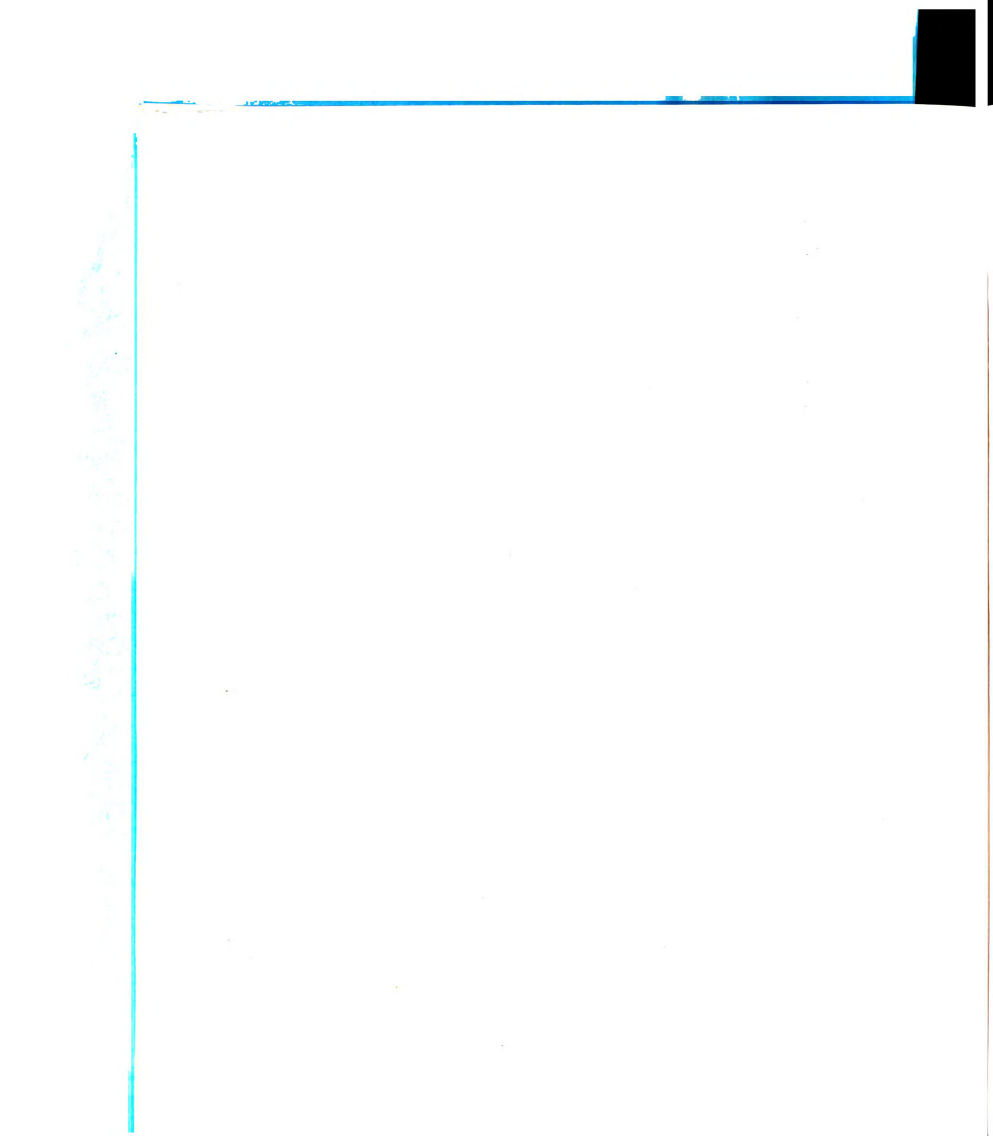
including the curriculum, instructional methods, instructional materials and equipment, and evaluation. These shortcomings have already been discussed and recommendations will be made for the reorganization of science education.

Science Curriculum

The present science curriculum should be modified to meet Nigerian conditions and needs. Whether in urban or rural communities, science courses must provide experiences which help the young to understand natural forces and phenomena. The major concepts and conceptual themes of the science disciplines should form the primary basis for the selection and organization of specific content and experiences in science education. Shamos has explained why the conceptual approach is necessary by stating that to escape the threat of obsolescence, education in the sciences must be based upon the kind of information that has survival value. In other words, to make science education meaningful to the average man throughout his lifetime, it must be based upon the kind of ideas that have survival value, not upon trivia.¹

Science education in Nigerian schools has, for the most part, concerned itself with trivia, or it has been

¹Morris H. Shamos, "The Role of Major Conceptual Schemes in Science Education," The Science Teacher, XXXIII, 1 (January, 1966), 28.

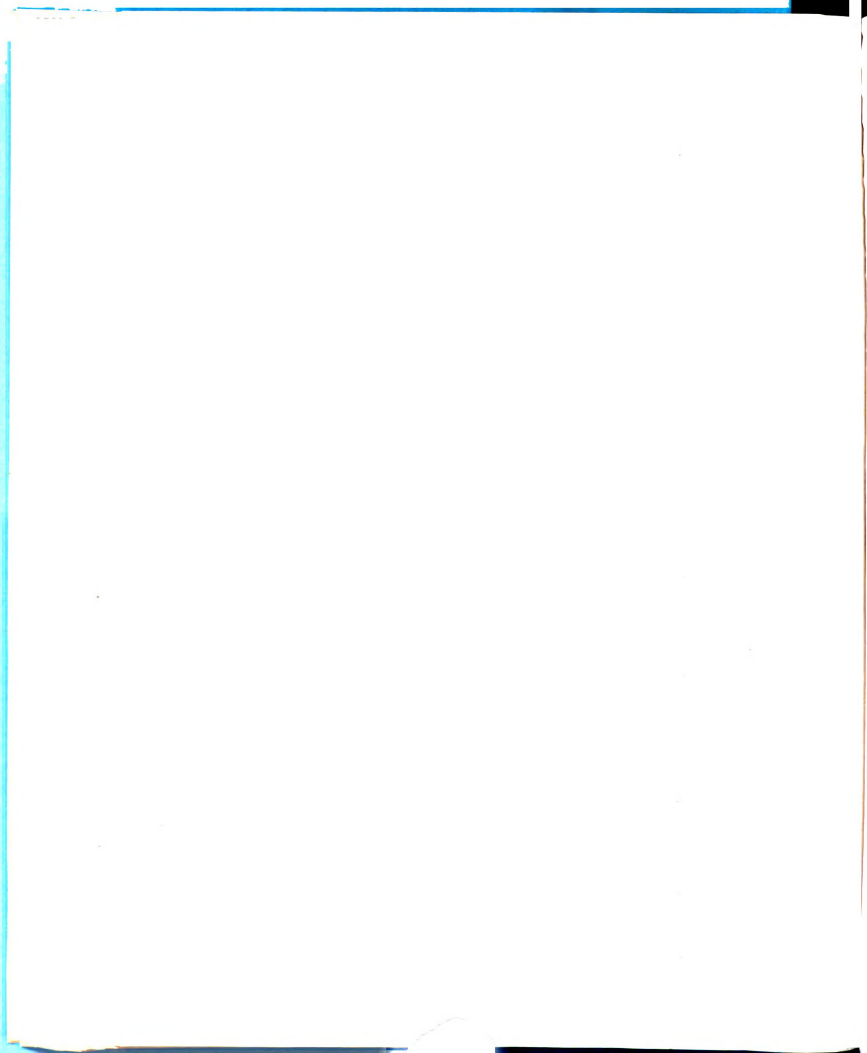


organized in such a way that whatever substantive ideas were contained in it have been submerged in a morass of detail. According to the Association for Science Education, scientific literacy means much more than the acquisition of factual knowledge. It means also an understanding of the basic nature and scope of science and appreciation of major scientific concepts, and their wider implications. These implications penetrate the everyday routines of home, field, factory, office, and elsewhere, the broader matters of community life with which we are concerned as citizens, and the deeper realms of human life and destiny. We need to understand scientific concepts and their implications, not only for their practical utility, but also because they are outstanding creative achievements of the human intellect and imagination.²

The time has come when the science curriculum in Nigeria should be reorganized. The following suggestions are offered:

1. The objectives should be concerned with developing students' powers for observation, critical thinking, and problem solving.
2. Societal needs should serve as a criterion for the selection of content. For example, the young people should be given an

²Association for Science Education, Science and Education (London: John Murray Ltd., 1963), p. 7.



opportunity to gain a better understanding of the use of science and technology in providing for human needs in such areas as food production, health, nutrition and conservation, and problems such as tribalism and superstitious beliefs.

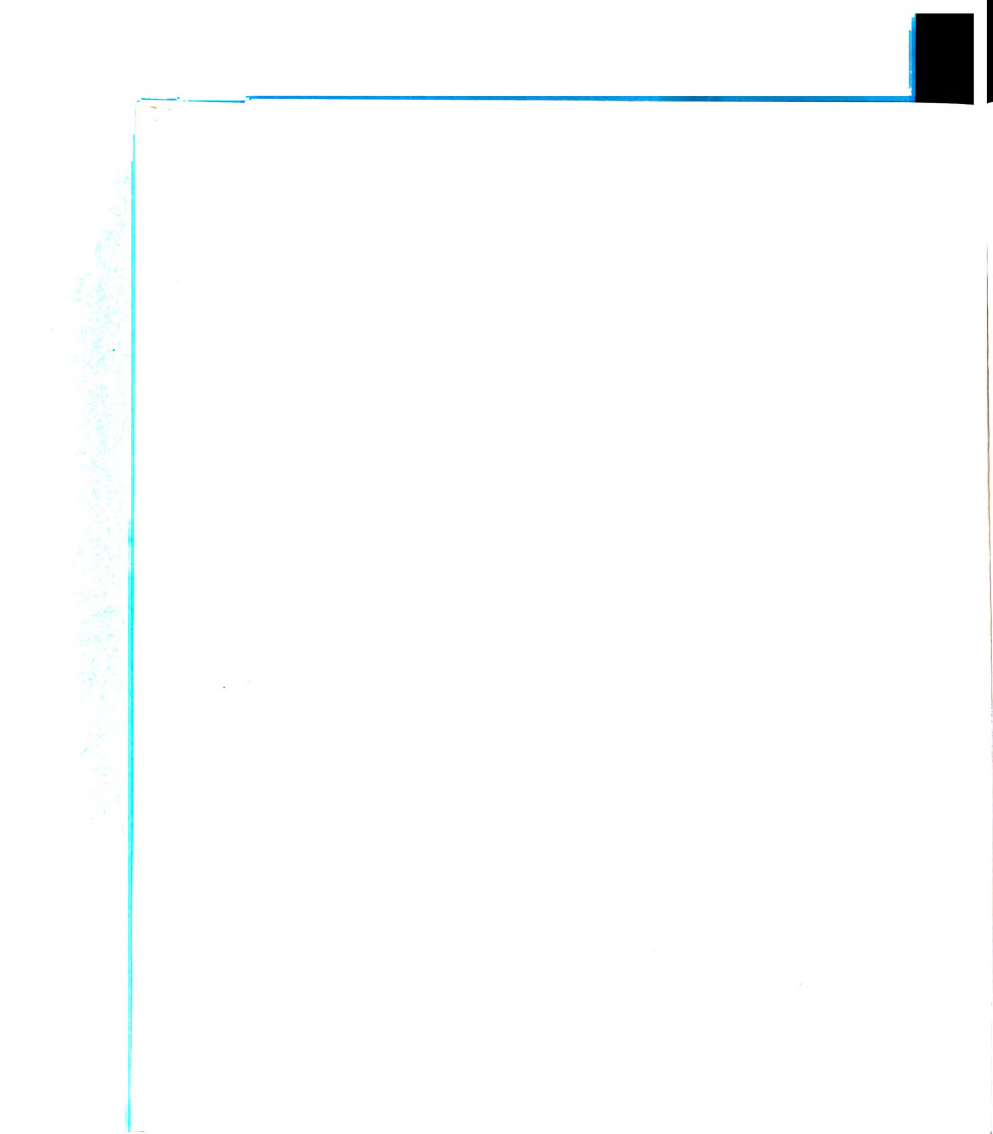
3. The curriculum should be flexible in order to accommodate the differences in backgrounds, interests, abilities, and the localities of the students. For example, in fishing areas, courses in fish management, including artificial breeding of the local fauna, will be more useful than teaching the students about ice fishing in a foreign country.
4. Science courses must be planned in such a way that students would be able to understand natural phenomena in terms of cause and effect. Natural phenomena such as the rainbow, rain, thunder, lightning and the eclipses of the sun and moon have often been explained in Nigeria through superstition. For example, some people say that there are many stars in heaven as there are people on earth; and when a person dies, a star is dislodged from the atmosphere. A child may be told that a shooting star signifies the death of a rich man. He is told that the witch doctor makes rain and can



send thunder to kill his enemy or destroy his home or property. Science education has a role to play in eliminating superstitions and explaining the natural phenomena in scientific terminology.

The areas of study suggested for reorganizing science education at the elementary level are as follows:

1. The Earth: Natural Phenomena and Forces
 - a. Waters of the Earth and Their Uses
 - b. Rocks and Minerals
 - c. Rotation and Revolution of the Earth
 - d. The Seasons, Climate and Weather
 - e. Volcano
 - f. Erosion
 - g. Diastrophism
 - h. Physiographic Regions
 - i. Formation and Conservation of the Soil
2. The Atmosphere
 - a. The Sun
 - b. The Moon
 - c. The Eclipses: Sun and Moon
 - d. Stars and Galaxies
 - e. Air Pressure and Winds
 - f. Lightning and Thunder
 - g. Moisture and Rain
 - h. The Tides



- i. Cyclones and Anticyclones
- j. Weather Observation
- 3. Time and Place on the Earth
 - a. Location of places on the earth: Latitude and Longitude
 - b. Maps: Nigeria, Africa and the World
 - c. Time: Standard Time, International Date Line, and Calendars.
- 4. The Body
 - a. Tissues, Organs, Glands
 - b. Functions of the Systems of the Body: Skeleton, Muscle, Skin, Nerve
 - c. Respiration
 - d. Circulation
 - e. Ingestion and Digestion
 - f. Excretion
 - g. Care of the Body and Good Health Habits
- 5. Diseases, Causes, and Prevention
 - a. Common Diseases Such as the Malaria Fever, Sleeping Sickness, Dysentery, and Worm Diseases, e.g., Guinea Worm, Tape Worm, Flat Worm and Hook Worm
 - b. Prevention of Diseases: Personal Cleanliness, Public Health Methods
- 6. Food and Nutrition
 - a. Foodstuff: Calories and Nutrition

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- b. Food Preparation
- c. Good Eating Habits
- d. Food Preservation
- 7. Water
 - a. Local Sources of Water Supply
 - b. Characteristics and Uses of Water
 - c. Purification Methods
- 8. Air
 - a. Composition of Air Including the Properties, Uses, and Effect of Oxygen, Carbon Dioxide, Nitrogen, and Water Vapor
 - b. Air and Health: Effects of Humidity, Temperature and Pollution
- 9. The Local and Regional Fauna, Characteristics, Adaptations and Classification
 - a. Insects: Useful and Harmful Ones: Insect Control
 - b. Animals: Domestic and Wild Animals
 - c. Birds
 - d. Fish
- 10. The Local and Regional Flora, Characteristics, Adaptations and Classification
 - a. Trees
 - b. Grasses
- 11. Conservation of Forests and Wildlife



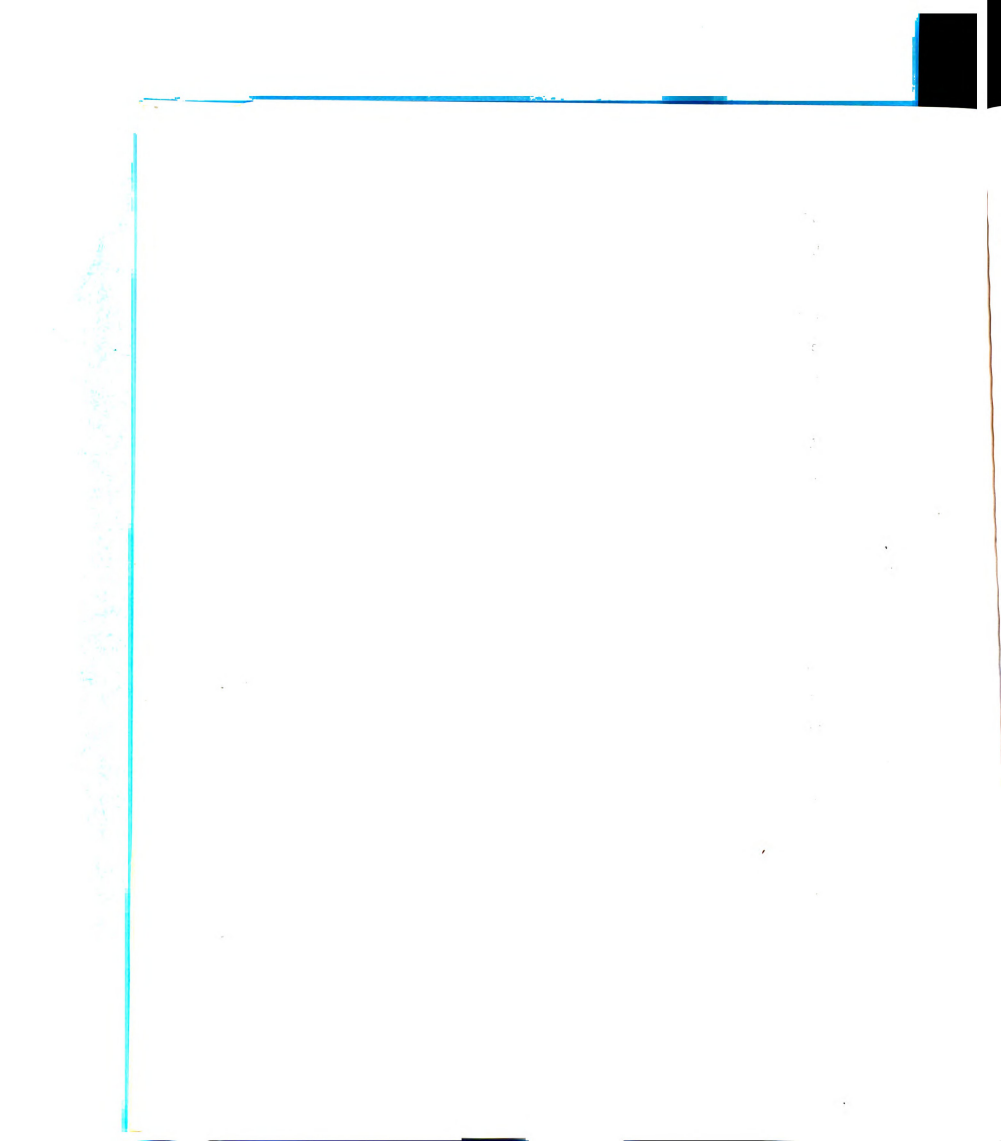
12. Electricity

- a. Electric Charges and Currents
- b. The Use of Electricity
- c. Electrical Devices

The above is a suggested science curriculum for the elementary schools in Nigeria. The program is not intended to be followed rigidly. Each school should determine the order in which the topics should be presented and at what level and time of the year they should be presented. Other topics of interest to the teachers and students should be studied.

The secondary school science program must coordinate with the elementary science program so that the latter facilitates learning in the former. The current science syllabi in biology, chemistry, and physics have been included in the appendix. On the basis of the syllabi, the following principles are suggested as a basis for reorganizing the science curriculum.

1. The program should be a perspective-giving, unified experience in the ideas, understandings, and techniques of modern science for each learner.
2. The program should be problem-centered, utilizing laboratory demonstrations and experiments to emphasize the ideas and uses of science. Thus it would promote thoughtful consideration and careful application



of science in proposing solutions for problems that are closely related to Nigerian society.

3. A minimum of one year each of biology, chemistry and physics should be required of all students. This will provide a basic knowledge in science for the students even if they do not complete their secondary school education.
4. Students who show high aptitude for science should be encouraged to study science throughout their secondary school career.
5. The science courses should include topics that arise out of the students' everyday needs, interests, and experiences.

The following recommendations are made to implement and improve the use of the current syllabi in the sciences.

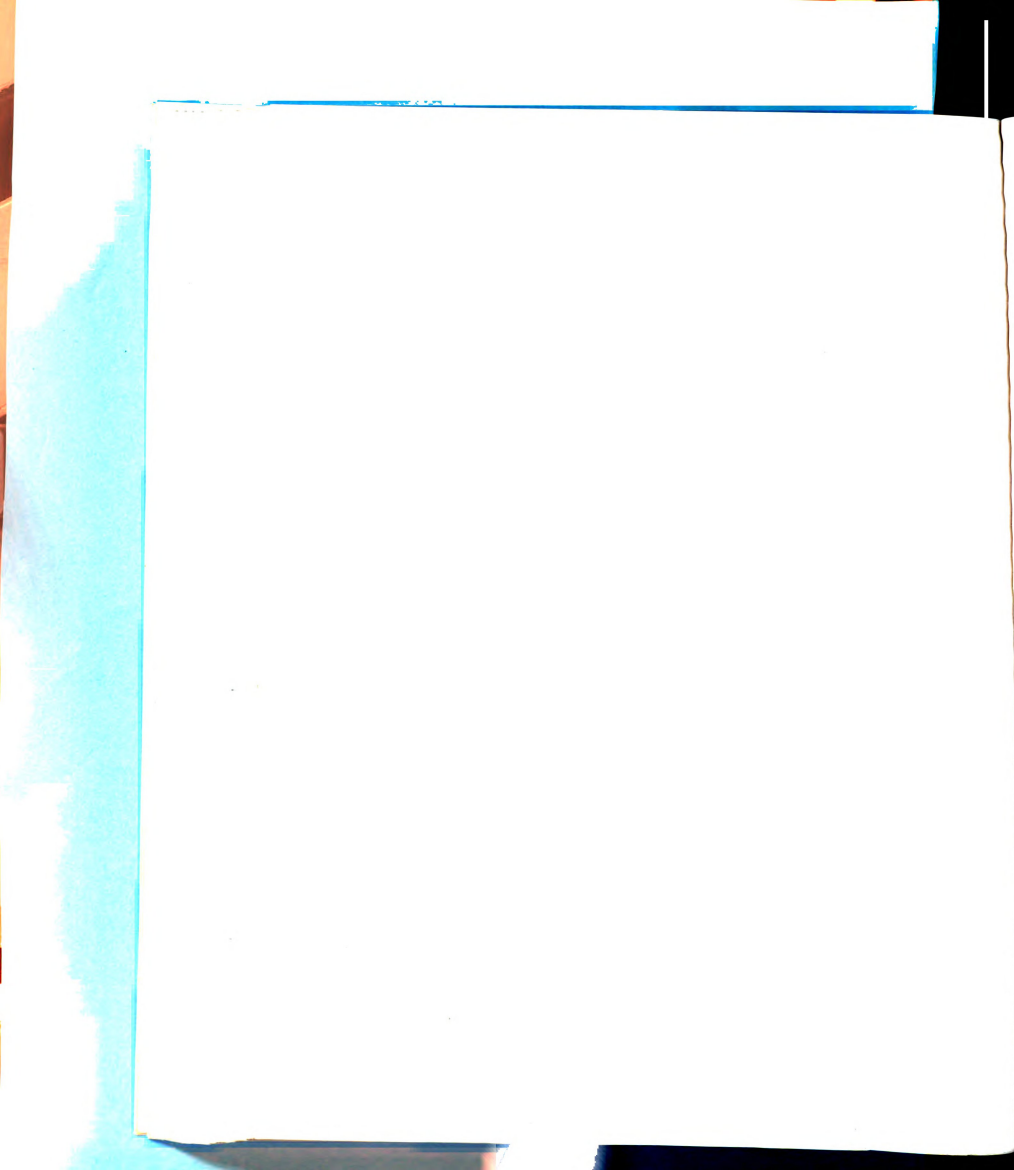
A. Biology

I. Revisions suggested for the current topics in the syllabus are as follows:

- (a) The topic on mammal should be expanded to include the local and regional fauna and their significance in Nigeria's economy.



- (b) In dealing with body systems such as the alimentary canal, circulatory system, respiratory organs, excretory organs, the brain and spinal cord, the ailments of these organs should be studied.
- (c) The topic on insects should emphasize the local and regional insects, both beneficial and harmful, insect control including biological, chemical, and integrated control.
- (d) Intestinal worms and their relations with man and animals should be discussed.
- (e) The topic on microscopic organisms should be expanded to include the organisms found in the locality. Field trips to the lakes, streams, and ponds in the locality should be made to study these organisms.
- (f) The local and regional flora should be studied in connection with the topic on plants. Their economic importance should be emphasized.
- (g) In dealing with the topic on ecology, tropical ecology should be emphasized since the students probably will spend most of their lives in Nigerian communities. This will acquaint them with the organisms in their environment and their interactions with them.



- (h) The topic on nutrition should deal with the local foodstuffs, their nutritional contents and the importance of a mixed diet.

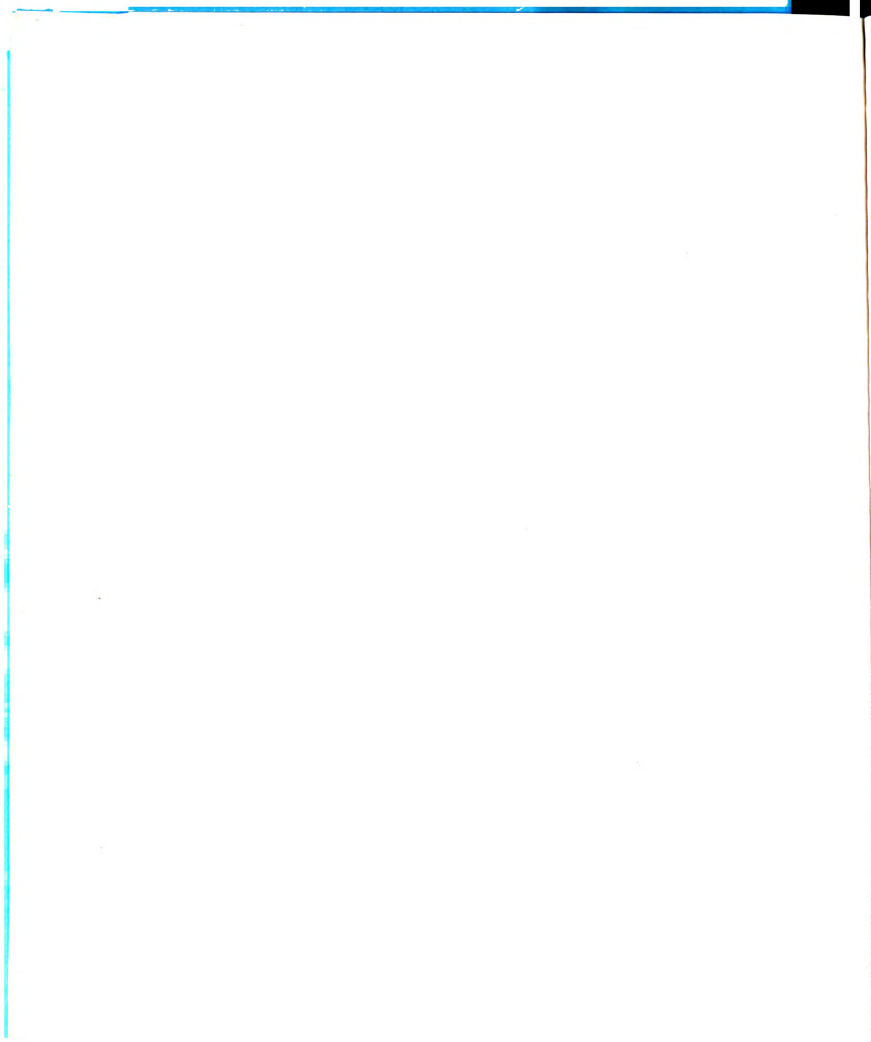
II. These are new topics for the syllabus:

- (a) A topic on conservation of forests and wildlife should be included in the biology curriculum.
- (b) Eugenics should be included with the following topics suggested:
 - (i) The improvement of the individual
 - (ii) Feeble-mindedness
 - (iii) Mental retardation
 - (iv) Birth and death rates
 - (v) Population problems.
- (c) Genetics should form a part of the biology curriculum.
- (d) The curriculum should include a topic emphasizing the importance of biology in an atomic age with regards to radiation hazards, causes and control of diseases

3. Chemistry

I. The suggested revisions for the current topics are as follows:

- (a) The topic dealing with metals and their chemical and physical changes should include methods of production and processing of iron



and steel. Ferrous metal parts such as the springs, bumper, wheel rims and chassis of an automobile should be discussed.

- (b) The rates of reaction and longevity of materials in the tropical region with its high temperature and humidity, differ from those of the temperate region. Therefore a topic on tropical meteorology should be included.
- (c) In discussing the topic on non-metals the production, properties and their alloys should be emphasized. Non-ferrous metal parts of an automobile including magnesium, zinc, aluminum, copper, chromium in alloys for such parts as cylinder heads, chromium plating and door handles should be examined.
- (d) The topic on water as a solvent should include an investigation of rust conditions and how to prevent rust. Some materials on which rust has occurred, such as the unpainted parts of a bicycle, plates and spoons, should be studied.
- (e) There should be a topic on the constituents and useful properties of oil and cellulose paints.



- (f) The discussion of the topic on general characteristics and properties of acids should include the differences between distilled water and tap water and the behavior of sulphuric acid inside and outside the battery of an automobile. Corrosion should be discussed.
- (g) The topic on combustion should include the various products of combustion, combustion of fuel with emphasis on oxidation and exothermic reactions.

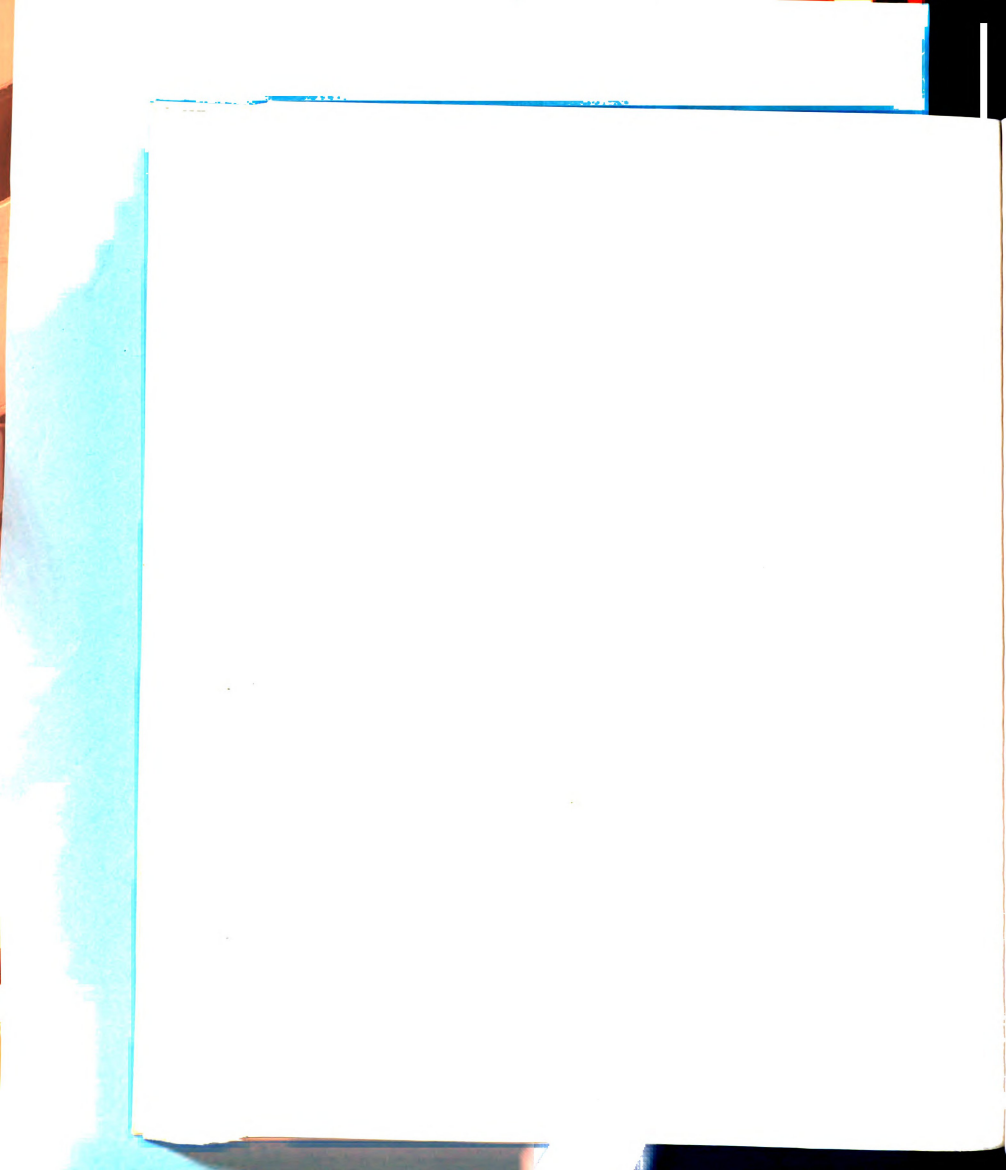
II. The new topics suggested for the syllabus are as follows:

- (a) The formation and refinement of motor fuels and oils should be studied.
- (b) There should be a topic on the use of radioactive tracer elements.
- (c) The role of chemistry in society should be included as a topic in the chemistry curriculum.

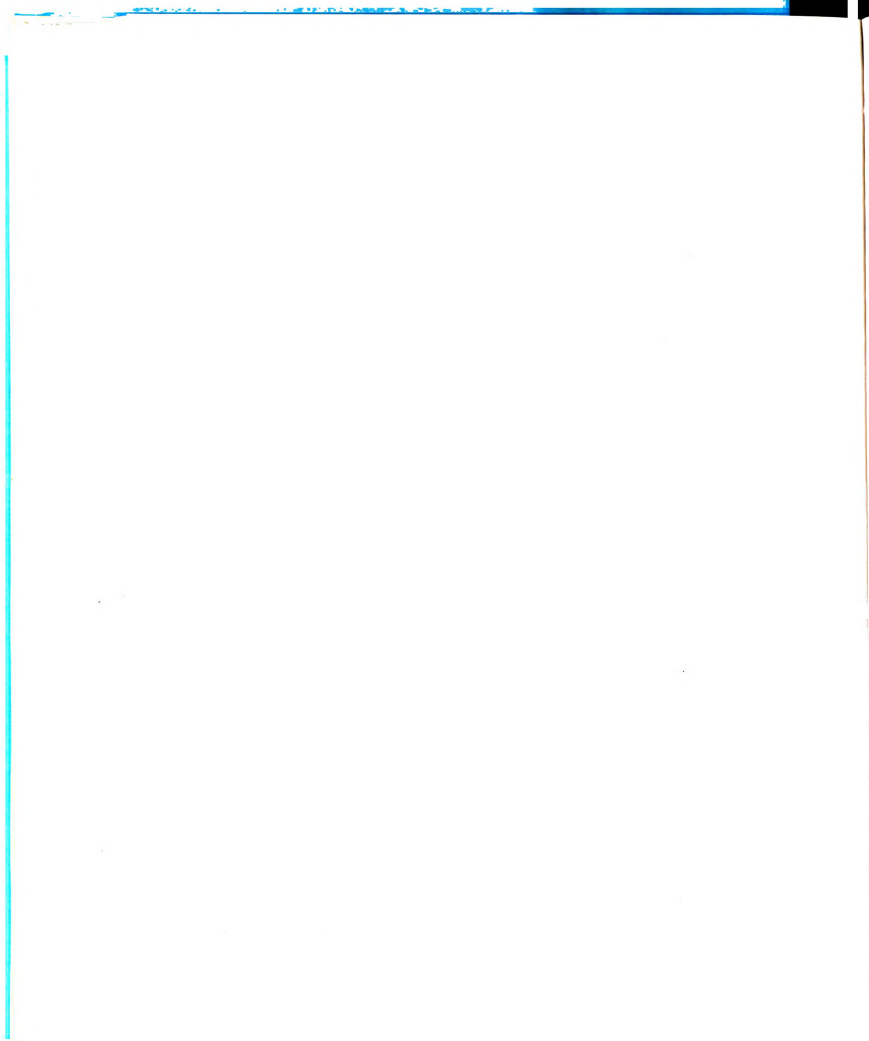
C. Physics

I. The suggestions offered for revising current topics are as follows:

- (a) The topic on measurement should add weights relating to vehicles, loads and taxation regulations.



- (b) In dealing with the topic on pressure in liquids and gases, hydraulic brake system, mixing of gasoline with air in the carburetor, controlled gasoline feed to engine depending on correct petrol level in float-chamber, induction and power strokes of engine cycle should be discussed.
- (c) The discussion of Boyle's law should include the pumping of tires and the variation in hardness of tires in relation to temperature.
- (d) The topic on velocity should include the action of brakes on a bicycle or a car, the effect of driving away a car that has been standing and the effect of a vehicle's motion during collision.
- (e) A discussion on Hooke's Law should include compression as well as tension in springs of cars, chairs and mattresses.
- (f) The topic on work, energy and power should also deal with the variation in speed of bicycles or other vehicles with the gradient of road.
- (g) In discussing friction, there should be emphasis on the friction between tires and road surfaces, the action of brakes, and the reduction of friction by lubrication.

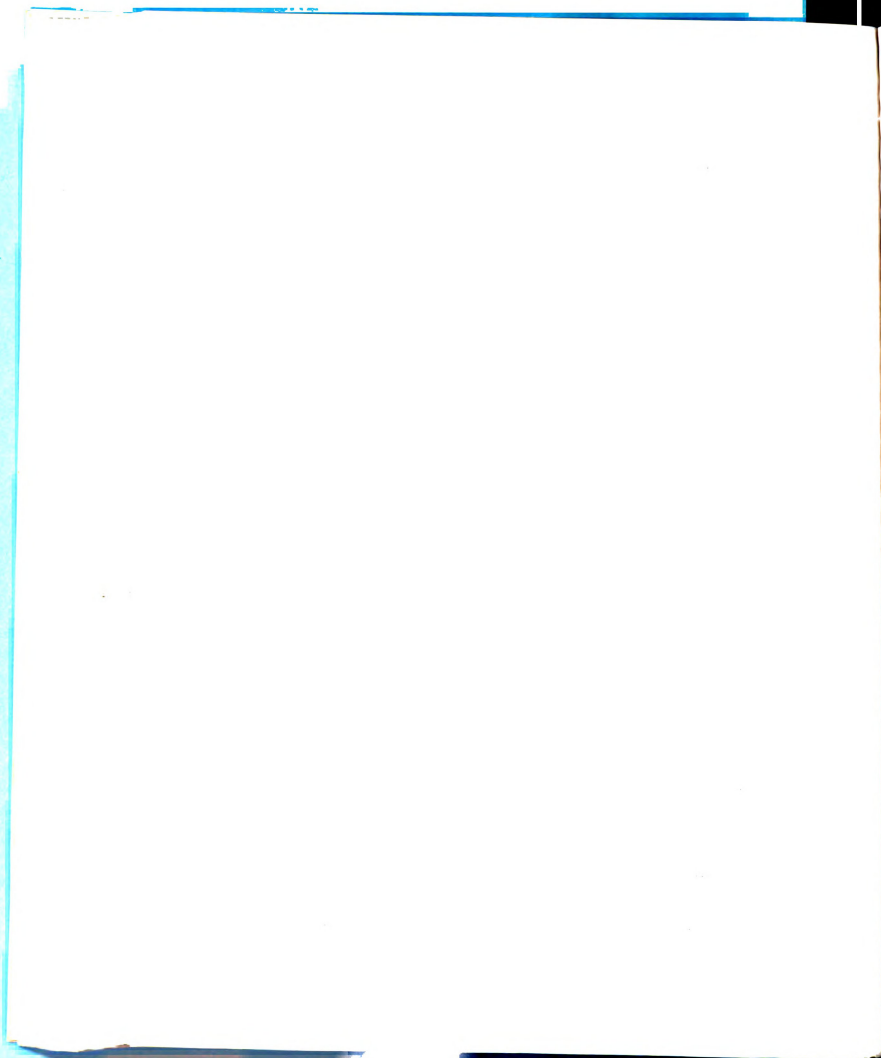


- (h) The topic on conversion of heat into work should include discussions on the motor-starter, the charging of the battery, and welding done by the blacksmiths.
- (i) The discussion on sound should emphasize the noise produced by vehicles at certain speeds, the horn of a car, the bell of a bicycle, the pitch, tone and resonance of indigenous musical instruments.
- (j) A topic on the compass should include the use of compass and practical work in using the compass to locate various points.
- (k) The topic on electricity should emphasize the various uses of electricity, and practical experience in wiring of a box or a room.
- (l) The physics of the human eye should include discussions on the effect of good lighting, eye diseases, and eye tests.

II. The new topics suggested are as follows:

- (a) The role of physics in society.
- (b) Radiation and its effects on health.

The suggested science curriculum for the secondary schools in Nigeria is not intended to be followed in the order that they appear above. It should be the responsibility of each school to determine the order in which



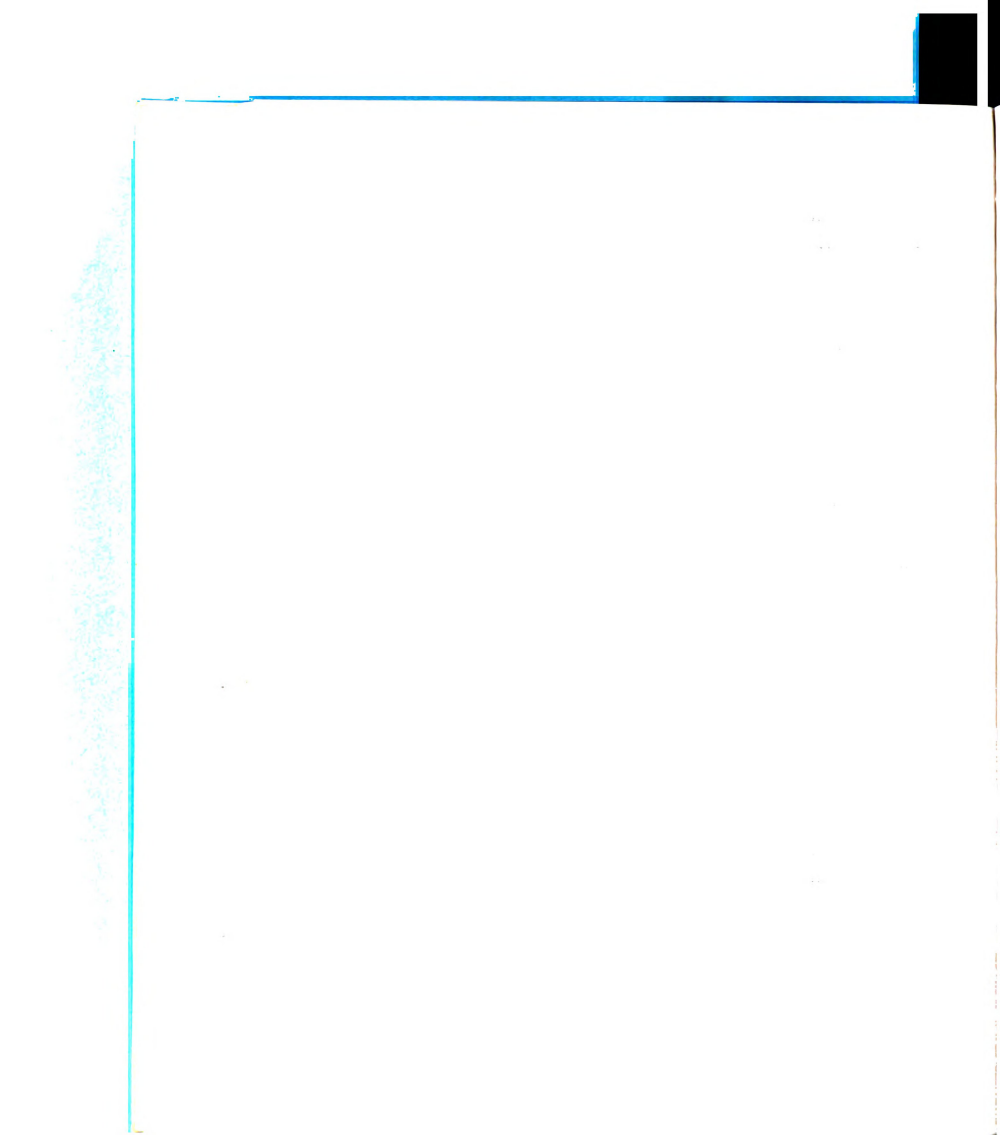
the topics should be studied, the level and time that they should be studied. The teachers and students should discuss other topics of interest to them.

Methods and Materials of Instruction

In conducting teacher-learning situations in Nigerian elementary and secondary schools, the common method followed currently is that of lecturing by the teacher which restricts students' participation, and thus tends to curb the students' exercise of creative powers. The prevalent concept of learning is rather narrow because it is limited to memorization of prescribed materials. Although memorization is considered a legitimate form of learning, it by no means includes all forms. Learning includes many types of behavior such as skills, concepts, generalizations, interests, attitudes, appreciations and techniques of problem solving.⁸

The overall picture of science teaching is rather gloomy. In many cases the method appears as a rather formal treatment of a large syllabus and lacking in experimental work. When used by inadequately trained teachers, such a method is bound to have just the defects, the bookishness, the formalism, and the remoteness from life, which make the system inadequate.

⁸G. Lester Anderson and Arthur Crates, "The General Nature of Learning," Learning and Instruction, Forty-ninth Yearbook of the National Society for the Study of Education, Part I (Chicago, Illinois: University of Chicago Press, 1950), pp. 12-35.

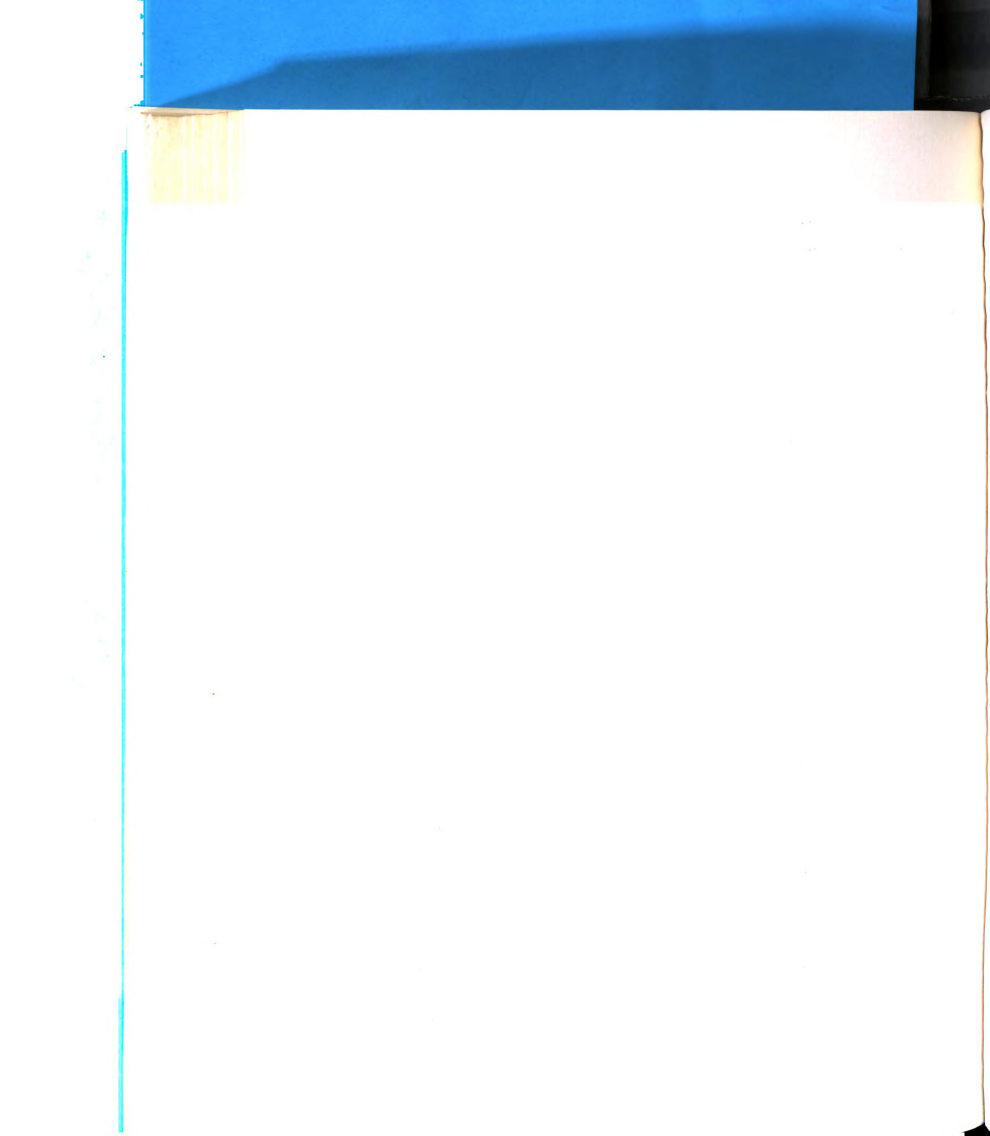


The fact-oriented approach as an end in itself to the teaching of science should be dropped. Ruchlis pointed out that people who absorb facts in a static way will find such mastery an obstacle to understanding the facts two decades later. Basically what is demanded of science teachers is that they make the methods of science the fundamental tool by which facts are to be gathered. This does not imply that facts are no longer important, but that they should not control our teaching methodology.⁹ We should aim at developing in our children the power to search for facts and the ability to evaluate them.

Abramovic has stated that a student should participate more fully in the processes involved in science studies rather than in the rote learning about the products.¹⁰ Perrodin has pointed out in his report that boys and girls want an opportunity to do things in science, to discuss what they are learning, to explore their curiosities, and to be able to ask questions. Lecturing, listening, copying notes, writing answers to the teacher's questions are not popular learning

⁹Hy Ruchlis, "An Experience with the Methods of Science," Science and Children, I, 2 (October, 1963), 16.

¹⁰Emil Abramovic, "New Approaches to Elementary Science Teaching," American Teacher Magazine, XLIX (October, 1964), 5-6.



activities.¹¹ Atkins commented that science teaching should stress the spirit of discovery.¹² Craig has said that the fundamental characteristic that is common to both children and science is that both are actively engaged in interpreting the objects and events of the environment.¹³

Children are full of curiosities and they ask many questions about many things. They are also interested in animals and plants. These qualities in children are undoubtedly necessary for studying science, and should not be overlooked by the teachers. There is a great satisfaction in discovering a difficult thing for oneself, and the teacher does the scholar a lasting injury who takes this pleasure from him.¹⁴ Children should be led to make their own investigations and draw their own inferences, and induce to discover as much as possible. It is, therefore, recommended that opportunities for learning be provided by allowing children to care for

¹¹Alex F. Perrodin, "Children's Interest and Elementary School Science," School Science and Math, LXV, 3 (March, 1965), 259-264.

¹²M. Atkins, "Science Education in Elementary School," Review of Educational Research, XXXIV, 3 (1964), 267.

¹³Gerald S. Craig, "Children and Science," Science Education, XL, 3 (April, 1956), 167-179.

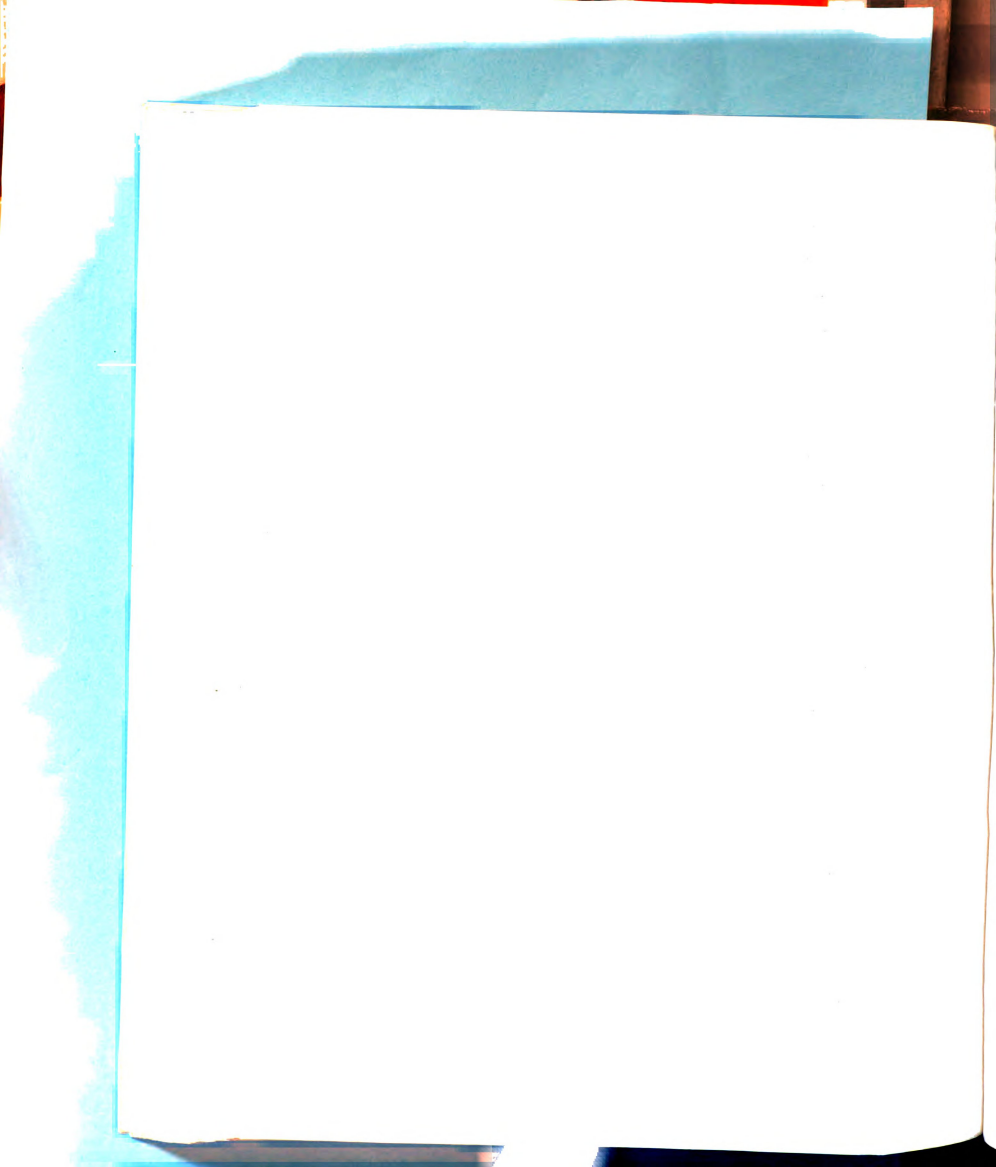
¹⁴David P. Page, Theory and Practice of Teaching (Syracuse, N. Y.: Hall and Dickson, 1847), p. 85.



birds and some small animals in the school, that some spaces be devoted for gardens so that under the teacher's guidance the children can learn while working there. Care of plants and flowers will provide areas for doing and learning by children. It is recommended that science courses for elementary grades be organized in problem areas composed of such questions as pertain to health habits, natural phenomena and forces, erosion, soil fertility, agriculture and nutrition.

The secondary school science program must coordinate with the elementary school science program. The objectives must be to maintain and extend the student's natural interest in science, to inculcate good habits of learning and good laboratory techniques, to encourage critical thinking and problem-solving techniques.

It must be understood from the onset that practical work should lead to the formulation of empirical laws and hypothesis, and, eventually, to simple ideas of great and far-reaching generalizations such as natural selection and kinetic theories. If this is done, science can be shown as to be a systematic study, resting on sound and logical foundations. In the entire course, every opportunity should be utilized to relate the facts and principles of everyday life and experience. There should be a judicious digression to discuss matter of immediate topical interest such as epidemics of some diseases and



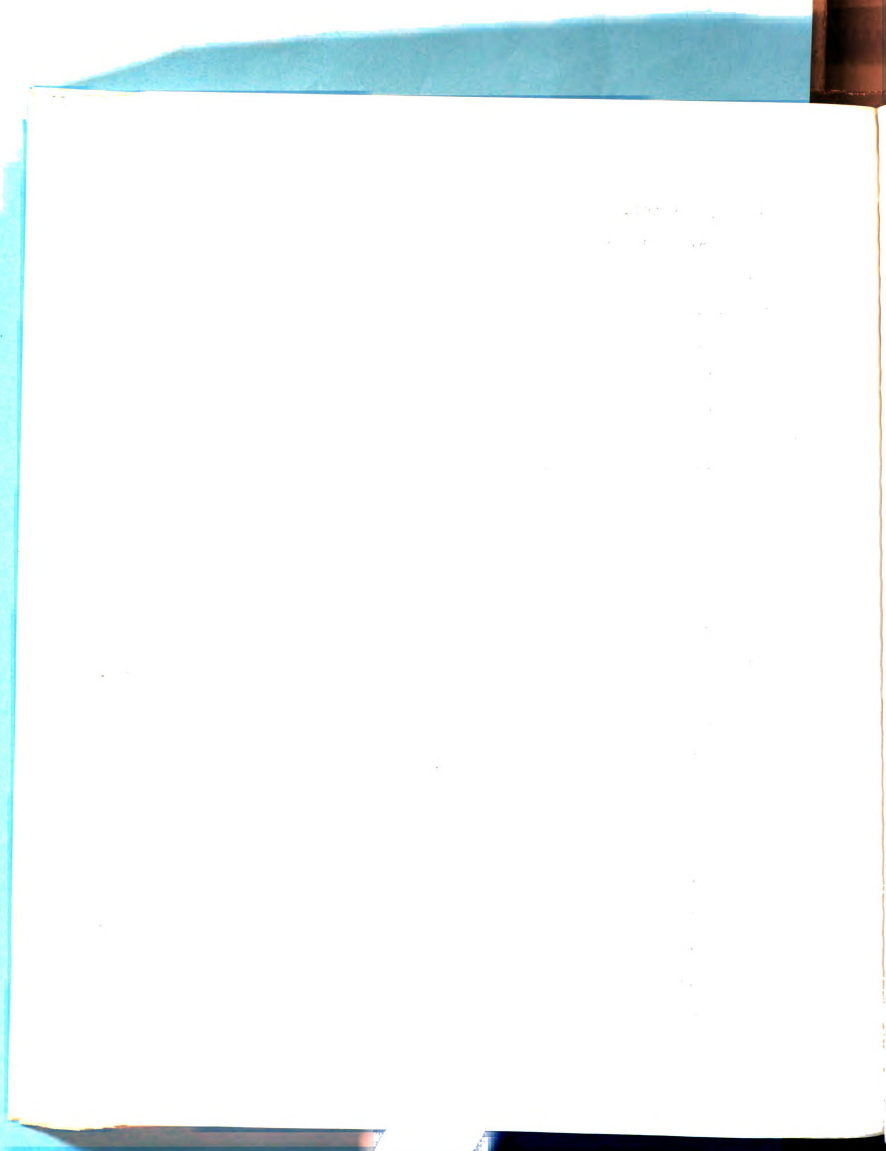
epidemiology. Nigeria has been plagued for many years by superstitious beliefs that distort facts about some diseases and other happenings. Therefore, the importance of distinguishing clearly between observational facts and the generalizations arising from them on the one hand, and, on the other, theories which may be no more than convenient fictions, should be emphasized.

It is recommended that science teachers should make the science courses more experimental, flexible, and thought provoking than the courses offered currently. The primary goals should be to provide real understanding, to stimulate reflection and critical thinking, to learn problem-solving technique, and to promote self-teaching thereby providing a basic literacy concerning the sciences which can be sustained by the students through self-teaching after they have left school. In a complex society the role of the science teacher becomes increasingly important in helping the student understand the world and life about him.

The philosophy which embodies the spirit of science as a mode of inquiry should pervade all courses of instruction in science. The science teachers should not aim only at teaching science but also at teaching useful knowledge. Discovery, creativity, reflective thought, analysis and synthesis are quite as basic to sound science instruction as the content itself. The methods

of teaching should be exemplified for their methodical values so that all students may experience something of the scientific temper and activity and gain at least an intuitive insight into science. The science teacher should see to it that science is presented as an open-ended, intellectual activity in which what is presently known or believed is subject to change without notice. Such a presentation would facilitate current interpretations of science rather than fixed absolute dogmas.

It is recommended that science teachers should use all available resources in the communities in which they teach. It is better to take a group of science students to a factory where soap is manufactured than to show them a picture of a soap manufacturing factory in Britain. It is recommended that science teachers should familiarize themselves with the flora and fauna of the regions in which they teach, and they should make appropriate collections of these in order to use them in their teaching when the need arises. A student may understand a lecture on leguminous plants better if he goes out with his teacher to collect the ones growing in his community than when he is confronted with the ones imported from England, which are already dried and preserved in plastic bags. It is recommended that science teachers should correlate their subjects with other school subjects such as geography and sociology. For example, when a science



teacher is teaching a lesson on the flora of a region, he should mention the geographical features of the region and the factors that are influencing the flora of the region.

Science teachers should help their students in formulating relationships between things, ideas, and events; and the results could be used for prediction, explanation and description. Conceptualization results from insight-fostering experience; and as inductive and deductive processes by which concepts are developed and employed go on, the students are naturally and inevitably involved in the methods that typify the scientific endeavor. For example, plant and animal breeding based on the laws of genetics, fundamental studies of plant and animal nutrition, scientific conservation of soils, and the improvement of health, form a part of the scientific endeavor that Nigeria must undertake. Therefore, science and its application for the improvement of the society should take a central place in science instruction in Nigerian schools.

Nigerian schools need good modern textbooks in science. These should be carefully selected and the contents should be highly appropriate, stimulating, and provocative for the age level for which they are designed. The readability of the text is of paramount importance. Illustrations should be of good quality.

Concepts and ideas within the text should be developmental; that is, there should be a clear-cut development from one idea to the next idea.¹⁵ The student should not be confined to a single text. Periodicals, journals, pamphlets and booklets and other publications that include some materials of interest to children who are learning science should be made available to them. School libraries should be furnished with science books for the various grade levels. It is imperative that simple science textbooks be written or translated into the vernacular for use in the lower grades where the children do not have adequate level of comprehension of the English language.

There should be provision made for visual aids in schools. Pictures should be carefully chosen for their accuracy and pertinence to the unit of work. Slides, filmstrips and motion pictures should be made available to schools and used when they are needed. Those used in teaching science must be such that encourage pupil comments and discussion. Objects and specimens such as flowers, insects, seeds, shells and rock, to name a few, give substance to learning experiences because they can usually be handled and should be used in schools. Modern science education requires materials

¹⁵John Gabriel Navarra, and Joseph Zaffaroni, Science Today for the Elementary School Teacher (New York: Row, Peterson and Company, 1960), pp. 37-38.

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for instruction. Hubler has stated that it is common knowledge that abstractions are hard to understand, and teaching soon becomes abstract without objective materials. Our knowledge of child development and the psychology of learning suggests that the use of suitable equipment and supplies is fundamental.¹⁶ Suitable instructional materials are essential if children are to investigate the true spirit of science.

It should be mentioned here that many of the supplies used by classroom teachers may be kept on hand in a central supply room in the building. A member of the staff may be given the responsibility for the procurement, care, and organization of these materials. These supplies should be checked out from the central room. Walsh has pointed out that the development of central storage facilities should go far to aid the implementation of a desirable science education program. The availability of equipment and supplies should encourage an upward revision of former goals and objectives associated with the curricula. He went on to say that in no instances should the availability or unavailability of an item dictate teaching aims. The knowledge that microscopes are available should encourage the teacher to plan an improved unit on microorganisms. The presence

¹⁶Clark Hubler, Working with Children in Science (Boston: Houghton Mifflin Company, 1957), p. 146.

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of the instruments should not in itself trigger a study of the microscope merely as an exercise or busy work.¹⁷

There is a need in Nigeria for a more actively inquiring and experimental approach to science teaching. It would be too much to claim that a course in school science will help people to accept modifications in their ways of life. Nevertheless, it may be better than nothing at all; and if students acquire an interest in science and some knowledge of its applications, they may feel more at home in this changing world. If they have experimented in growing new crops in the school garden, bred fish in the school pond, helped in a fight against mosquitoes, visited a power station, a telephone company, or an oil refinery, they are more likely to accept new ideas and changes. Community resources should be utilized as much as possible.

Teachers should accept field studies as an intrinsic part of a teaching program. In biology, for example, the laboratory period should be employed in aiding the student to find solutions to the problems raised in his environment as well as the classroom. The true spirit of science is that of curiosity and investigation, and science teaching should, throughout the school course, be organized with this in mind. If in the early years

¹⁷William J. Walsh, "Science Equipment Storage," Science and Children, I, 5 (February, 1964), 10.

curiosity is not encouraged and developed, and if science is not related to the local environment and to problems arising out of that environment, research projects will not help very much at more advanced stages of learning in science. Great attention should therefore be paid to experimentation, and teachers should make it a living part of the science program.

The integration of science concepts is vital to comprehension and the instructional process. We must apply the idea of subject integration if we are to achieve the depth of concept and retainability that appear so critical to the overall aim. Cooper has stated that integration begins at the very first lesson with references to events and terms still to be met. Terms are employed irrespective of their currency if they help explain a point that is revealed or to be revealed.¹⁸ The thread of continuity in science is an important way to approach true knowledge. Even in this age of discrete specialization the whole is equal to the sum total of all its parts. Teachers, therefore, should integrate their course objectives and activities as much as possible.

The schools should have the responsibility of presenting science as part of common cultural and humanistic

¹⁸Philip L. Cooper, "Scientific Integration, A Proposal," American Biology Teacher, XXVII, 1 (January, 1965), 44-45.

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heritage of the people. Science should be taught in harmony with, not in opposition to, the various arts subjects which alone have hitherto been regarded as humanities. Such a presentation will help to produce a climate of opinion in which science can flourish, and in which scientific advances can be applied for the common good.

Evaluation

The system of evaluating students' learning should be reorganized. The prevalent examination procedure tends to emphasize the ability of the student to memorize prescribed materials. It is important for the teachers to determine how well children are attaining the objectives established for the science program. This appraisal of children's progress should begin as soon as teachers and children start working together and should continue through the development of each unit which is part of the curriculum.

It is recommended that examinations should be set and marked locally. Deakin pointed out that there is a great advantage to the pupils and to all concerned in education in West Africa in having the School Certificate examinations set and marked locally, because syllabus changes can be brought about more quickly and papers can be set having regard to the needs of the local candidates only and not to those all over the world, as must be the



case with the examinations set by London and Cambridge for a world-wide market.¹⁹ This will also give the teachers a better chance of assessing the work of their students.

The process of evaluation should begin with cumulative findings about the students. The teacher should know the student's mental ability, achievement status in school subjects, emotional adjustment, experience background and all other pertinent information. Parallel to the study of the child, the teacher should make a careful appraisal of the environmental setting. The possibilities and limitations in the resources of the teacher, school, home and community should be known. Kambly and Suttle pointed out that one of the very important responsibilities of teachers is to determine how well children are attaining the objectives established for the science program. Accurate evaluation is primarily important because of its effect on the teachers and the children's performance and on improvements of the curriculum.²⁰ Nigerian school authorities must create an atmosphere that will make the true essence of

¹⁹J. Deakin, "Changes in Examinations for West African Secondary Schools," West African Journal of Education, VIII, 2 (June, 1964), 71.

²⁰Paul E. Kambly, and John E. Suttle, Teaching Elementary School Science, Methods and Resources (New York: The Ronald Press Company, 1963), p. 106.

evaluation possible, as well as to develop minimal teacher competence in interpreting and utilizing the materials.

Teacher Training

Nigeria must embark upon a well-balanced program of teacher training. Teacher education will be affected by cultural change to the same extent that the program of science education is affected. The professional education of a science teacher should constitute a cohesive, integral, and developmental program that results in growth in the knowledge, insights, concepts, and skills a teacher needs for his work.

The program of teacher education suggested is as follows:

1. Science requirements.

There should be a minimum of a one year course of study undertaken in each of the following subjects:

- (a) Biology
- (b) Chemistry
- (c) Mathematics
- (d) Physics.

2. Professional education courses:

- (a) Educational Psychology
- (b) Adolescent Psychology
- (c) Social Foundations of Education including

History, Philosophy, and Sociology of
Education

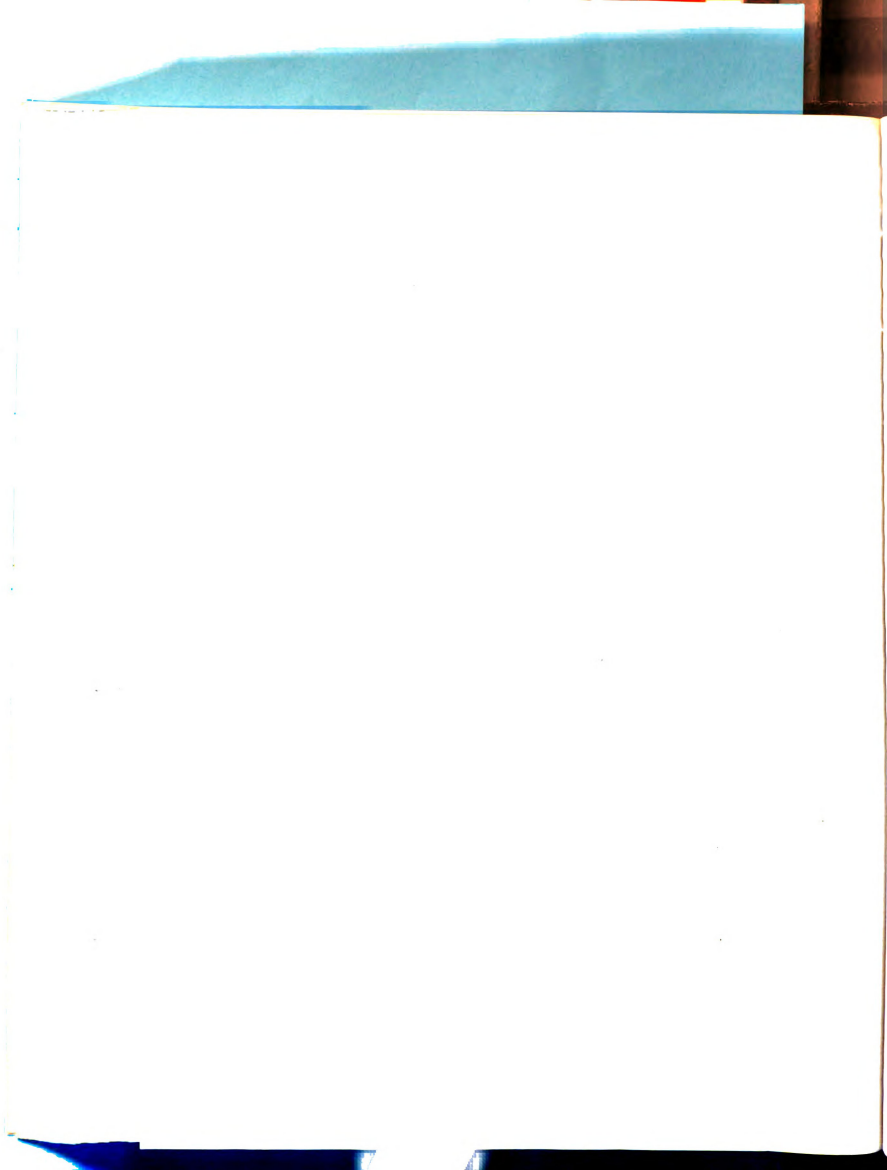
- (d) Comparative Education
 - (e) Science Education Methods
 - (f) Audio Visual Materials
 - (g) Tests and Measurements
 - (h) Practice Teaching
3. General Education
- (a) Social Sciences
 - i. Sociology
 - ii. Anthropology
 - iii. Psychology
 - iv. Geography
 - v. Economics
 - vi. Political Science
 - (b) Languages
 - i. Native (Nigerian) Language
 - ii. English Language
 - (c) Humanities
 - i. History
 - ii. Philosophy
4. Area of Concentration (Major)

It is suggested that each prospective science teacher should take a minimum of ten courses (30 semester hours--American equivalent) in his major field. A minimum of seven courses

should be completed before practice teaching.

Each student should plan his entire program with his advisor. The courses suggested may not be taken according to the order in which they have been listed.

In-service education is a good way of helping teachers in the field to be of greater service to youth. Many science teachers are not adequately prepared for the work that they are doing. It is necessary that they secure a solid background in the sciences they teach. There are those who have not kept up with advances in their fields. For them, work designed to bring them abreast of these advances is necessary. The teachers whose backgrounds in science are adequate and who wish to find other means of strengthening their teaching, may take professional education courses. Specially designed courses also may be offered for science teachers with science majors. These should include seminars as well as laboratory opportunities designed to acquaint science teachers with recent advances in the sciences and in science teaching. Field work, independent study, and research are also avenues by which increased teaching effectiveness may be attained. Seminars and workshops should be conducted periodically, and science teachers should avail themselves of the opportunities thus provided.



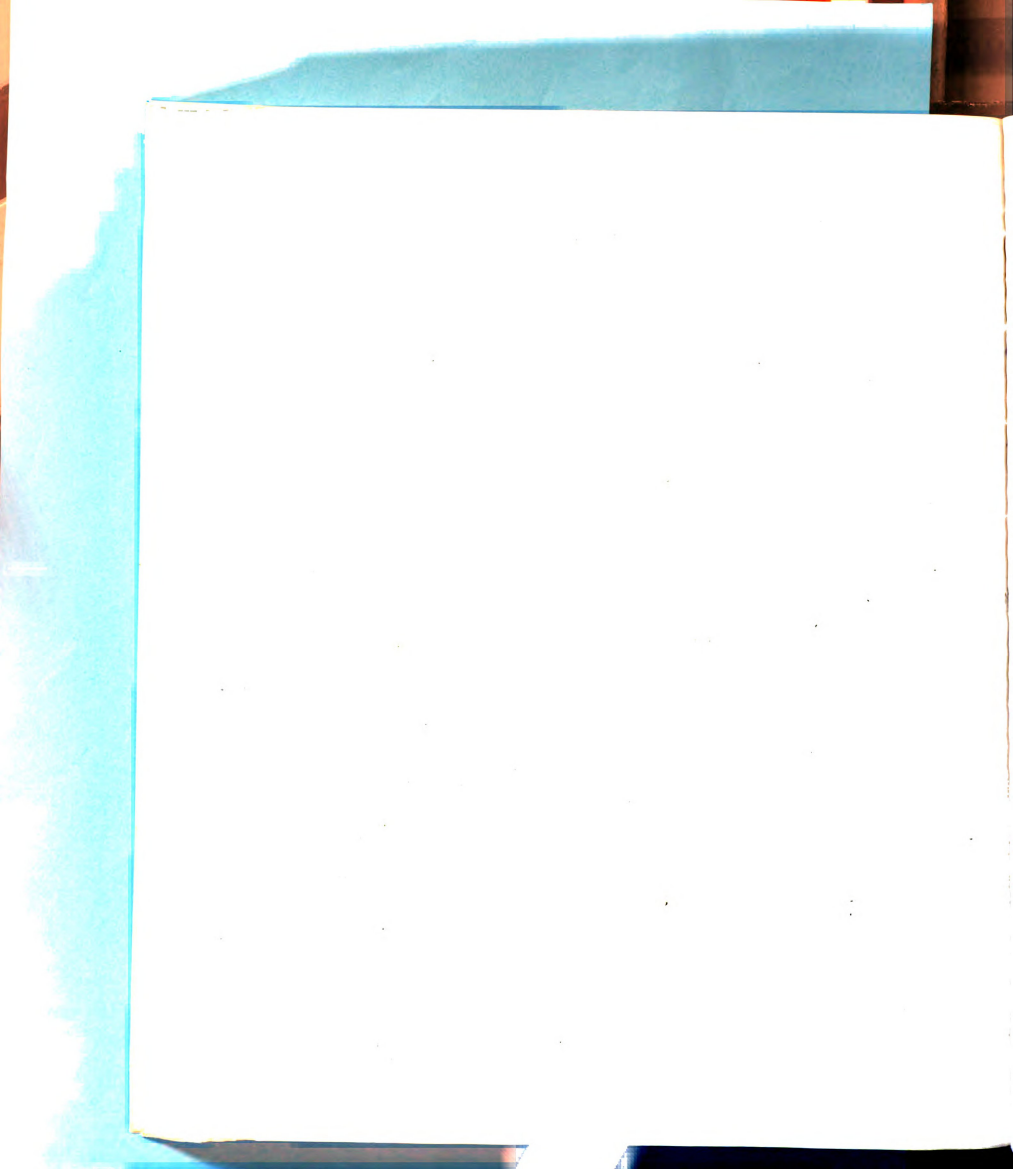
It has often been said that teachers tend to teach as they were taught, not as they were taught to teach. Uselton et al. pointed out that the way in which teacher candidates have been taught has an important bearing on the way they themselves teach.²¹ It is very important, therefore, that college personnel who have the responsibility of planning and supervising the programs of study and of preparing prospective teachers be competent teachers.

Implications and Recommendations for Further Study

Great shortcomings exist in the present science education in Nigerian schools. The present teaching methods and techniques are the results of a system in which the passing of examinations has had greater influence than the actual acquisition of usable knowledge. Many teachers are not adequately prepared for classroom teaching and therefore lack the knowledge and training necessary for them to do a good job. Existing programs for the training of teachers are inadequate.

A considerable problem also exists with the selection and use of textbooks and other teaching materials. Lack of adequate facilities in the schools

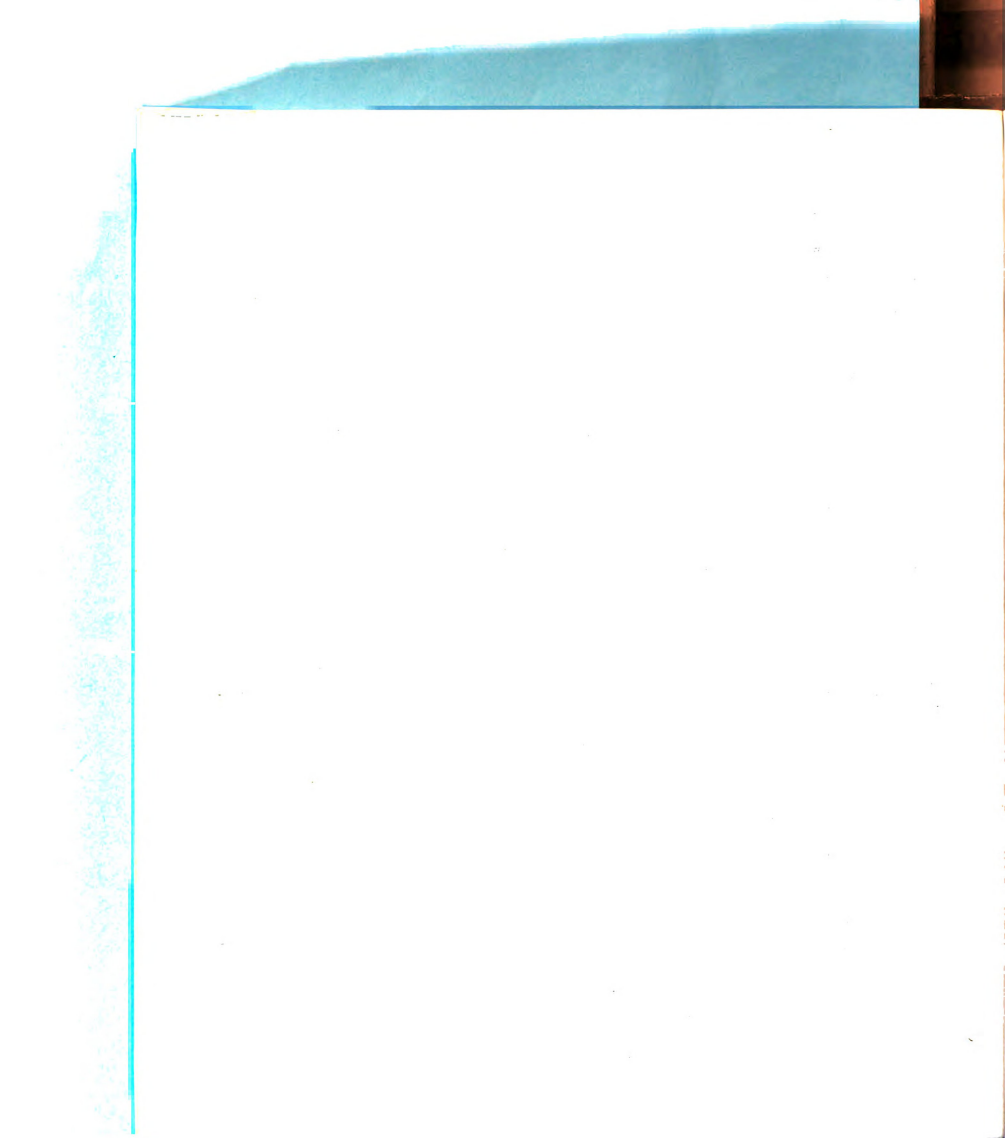
²¹Horace W. Uselton, Joseph C. Bledsoe, and Charles L. Koelache, "Factors Related to Competence in Science of Prospective Elementary Teachers," Science Education, XLVII, 5 (December, 1963), 508.



and in some communities pose serious problems to science education especially where the curriculum is inadequate to cope with local problems and needs. With a traditional system of evaluation confined to examinations which encourages rote memorization there is a need for an inquiring, integrating, and experimental approach, as common characteristics of science instruction.

The great potentiality of science as a dynamic force for cultural change in Nigeria is obvious. The country has not as yet been fully exposed to the most profound and rapidly accelerating changes of the modern world, with regard to health, nutrition, industrialization, and economic development. If the scientists and technology needed by Nigeria are to be forthcoming in anything like the numbers in which they are needed, the spirit of original enquiry and investigation, critical thinking and problem solving techniques must be fostered in the schools. Further study of the relationship between teaching methods and the attitudes of students towards science subjects is recommended.

The importance of a well-rounded teacher training program cannot be overemphasized. What is also needed is a new approach to teaching systems, in which the teacher, the technology and the curriculum are defined in relation to one another, bearing in mind the feasible teaching objective, the available resources, and the learning characteristics of the children.



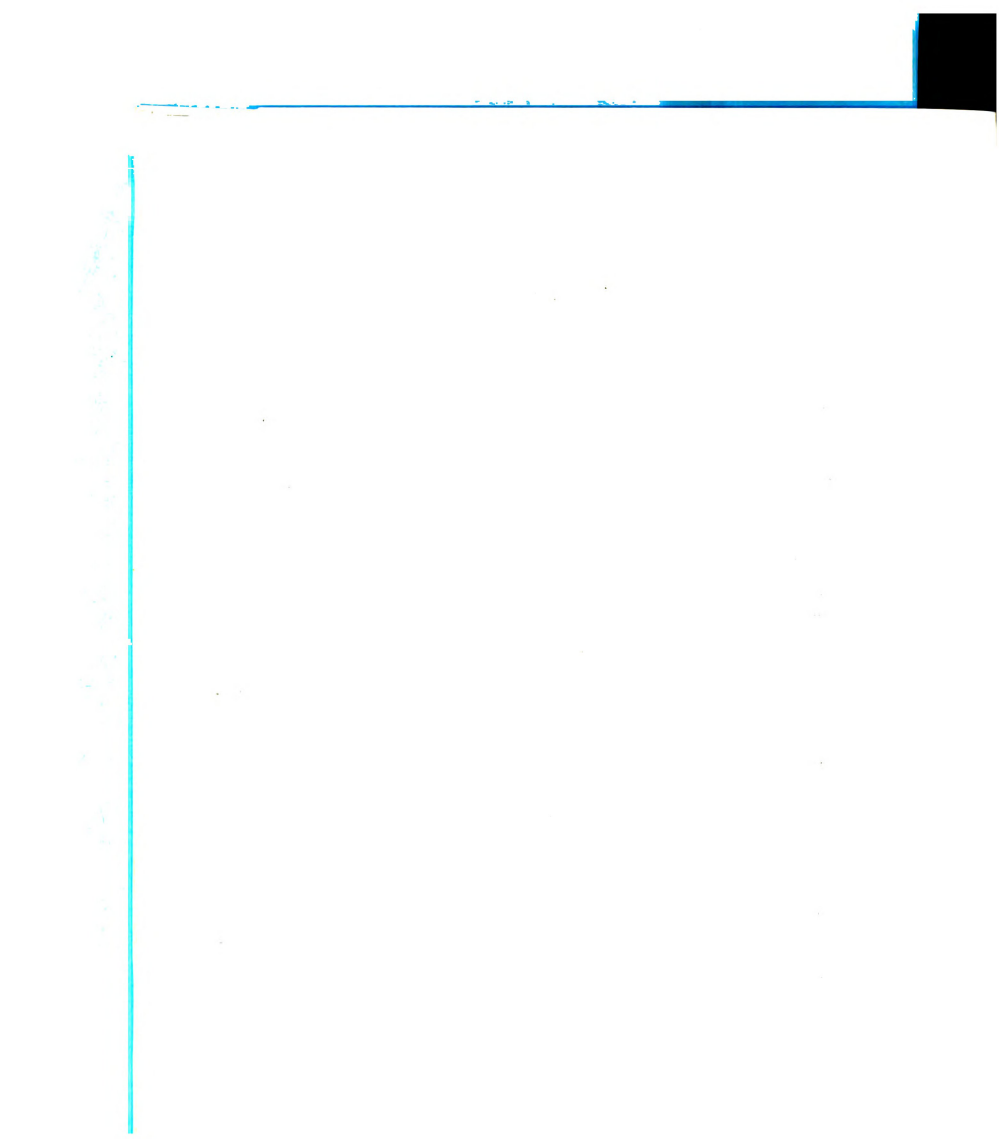
The science syllabi should be reorganized so that from the beginning students are encouraged to think for themselves, to read widely, to observe the world around them and to work singly or in groups to find the causes of natural events which take place around them. It is in this area of syllabi, that further research is needed. It is, therefore, recommended that studies concerning the relationship between the content of teaching programs and public examination syllabi be undertaken.

The need to educate for citizenship cannot be over-emphasized. Many people in Nigeria honor education, but few understand its larger purposes. The thinking of education has been shallow, constructed, and lacking in reach and perspective. The educational purposes must be seen in a broader framework, for Nigeria needs people with talent, tact, intelligence, and dedication in order to accomplish the great task of nation-building. There is no doubt that a good science education program will offer a strong basis for the future, a foundation for the people's aspirations, and a bridge to a better tomorrow. It is hoped that this study will contribute to the improvement of Nigerian science education which may eventually facilitate the improvement of the welfare of the people of Nigeria.





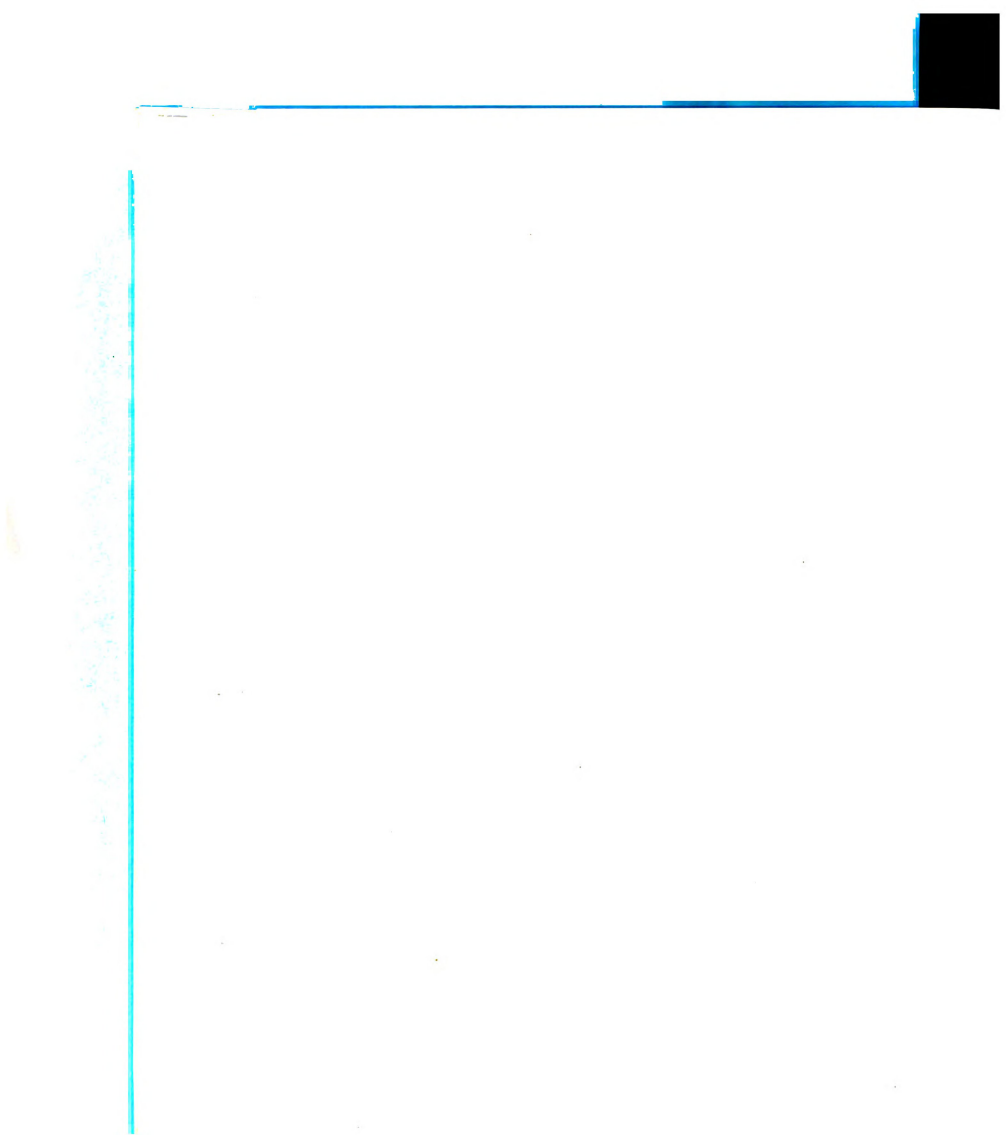
BIBLIOGRAPHY



BIBLIOGRAPHY

Books

- Anderson, G. Lester and Arthur Crates. "The General Nature of Learning." Learning and Instruction. Forty-ninth Yearbook of the National Society for the Study of Education. Part I. Chicago, Ill.: University of Chicago Press, 1950.
- Ashby, Eric. African Universities and Western Tradition. Cambridge, Mass.: Harvard University Press, 1964.
- Bretton, Henry L. Power and Stability in Nigeria. The Politics of Decolonization. New York: Frederick A. Praeger, Publisher, 1962.
- Buchanan, K. M. and J. C. Pugh. Land and People in Nigeria. London: University of London Press Ltd., 1955.
- Charleson, W. R. Education and Training in the Developing Countries. Edited by Elliot. New York: Frederick A. Praeger, Publisher, 1966.
- Diamond, Stanley. Nigeria--Model of a Colonial Failure. New York: American Committee on Africa, 1967.
- Dike, K. O. "Development of Modern Education in Africa." The One and the Many. Edited by J. N. Brooks. New York: Harper, 1962. Cited in L. J. Lewis, Society, Schools and Progress in Nigeria. New York: Pergam Press, 1965.
- Gronze, Collin. "Preface." Nigeria--Model of a Colonial Failure. Edited by Stanley Diamond. New York: American Committee on Africa, 1967.
- Hanson, John. Imagination and Hallucination in African Education. East Lansing, Mich.: Institute of International Education, Michigan State University, 1965.



- Harbison, Frederick and Charles A. Myers. Education, Manpower, and Economic Growth. New York: McGraw-Hill Book Company, 1964.
- Hubler, Clark. Working with Children in Science. Boston: Houghton Mifflin Company, 1957.
- Ikejiani, O. Nigerian Education. Bristol, England: Longmans of Nigeria, Ltd., Western Printing Services, 1964.
- _____. Education in Nigeria. New York: Frederick A. Praeger, Publisher, 1965.
- Kambly, Paul E. and John E. Suttle. Teaching Elementary School Science, Methods and Resources. New York: The Ronald Press Company, 1963.
- Lacey, Archie L. and Virginia M. Rowley. Guide to Science Teaching in Secondary Schools. Belmon, Calif.: Wadsworth Publishing Company, Inc., 1966.
- Lewis, L. J. Phelps-Stokes Reports on Education in Africa. London: Oxford University Press, 1962.
- _____. Society, Schools and Progress in Nigeria. New York: Pergam Press, 1965.
- Navarra, John Gabriel and Joseph Zaffaroni. Science Today for the Elementary School Teacher. Evanston, Ill.: Row Peterson and Company, 1960.
- Niven, Sir Rex. Nigeria. London: Ernest Benn Ltd., 1967.
- Odum, Eugene P. and Howard T. Odum. Fundamentals of Ecology. 2nd Ed.; Philadelphia: W. B. Saunders Company, 1959.
- Onyemelukwe, C. C. Problems of Industrial Planning and Management in Nigeria. London: Longmans, Green and Co., Ltd., 1966.
- Page, David P. Theory and Practice of Teaching. Syracuse, N. Y.: Hall and Dickson, 1847.
- Perkins, W. A. and Jasper H. Stemberge. Nigeria: A Descriptive Geography. 2nd Ed.; London: Oxford University Press, 1962.
- The Royal Institute of International Affairs. Nigeria: The Political and Economic Background. London: Oxford University Press.

Weiler, Hans H. Erziehung und Politik in Nigeria.
Gmbh, Freiburg im Breisgau: Verlag Romback and
Co., 1964.

Articles

Abramovic, Emil. "New Approaches to Elementary Science Teaching." American Teacher Magazine, XLIX (October, 1964), 5-6.

Adam, Samuel C. "Education and Independence." Phi Delta Kappa, (January, 1960), 162-163.

Alexander, C. L. H. "Secondary School Leaving Examinations in Nigeria." Oversea Education, (April, 1961), 9-10.

Association for Science Education. Science and Education. London: John Murray, Ltd., 1963, 7.

Atkins, M. "Science Education in Elementary Schools." Review of Educational Research. XXXIV, 3 (1964), 267.

Bunting, J. R. "Tradition and Innovation in Secondary Education." West African Journal of Education, V, 2 (June, 1961), 41-42.

Chaplin, B. H. G. "Elementary Science: A Revised Approach." West African Journal of Education, II, 2 (June, 1958), 68.

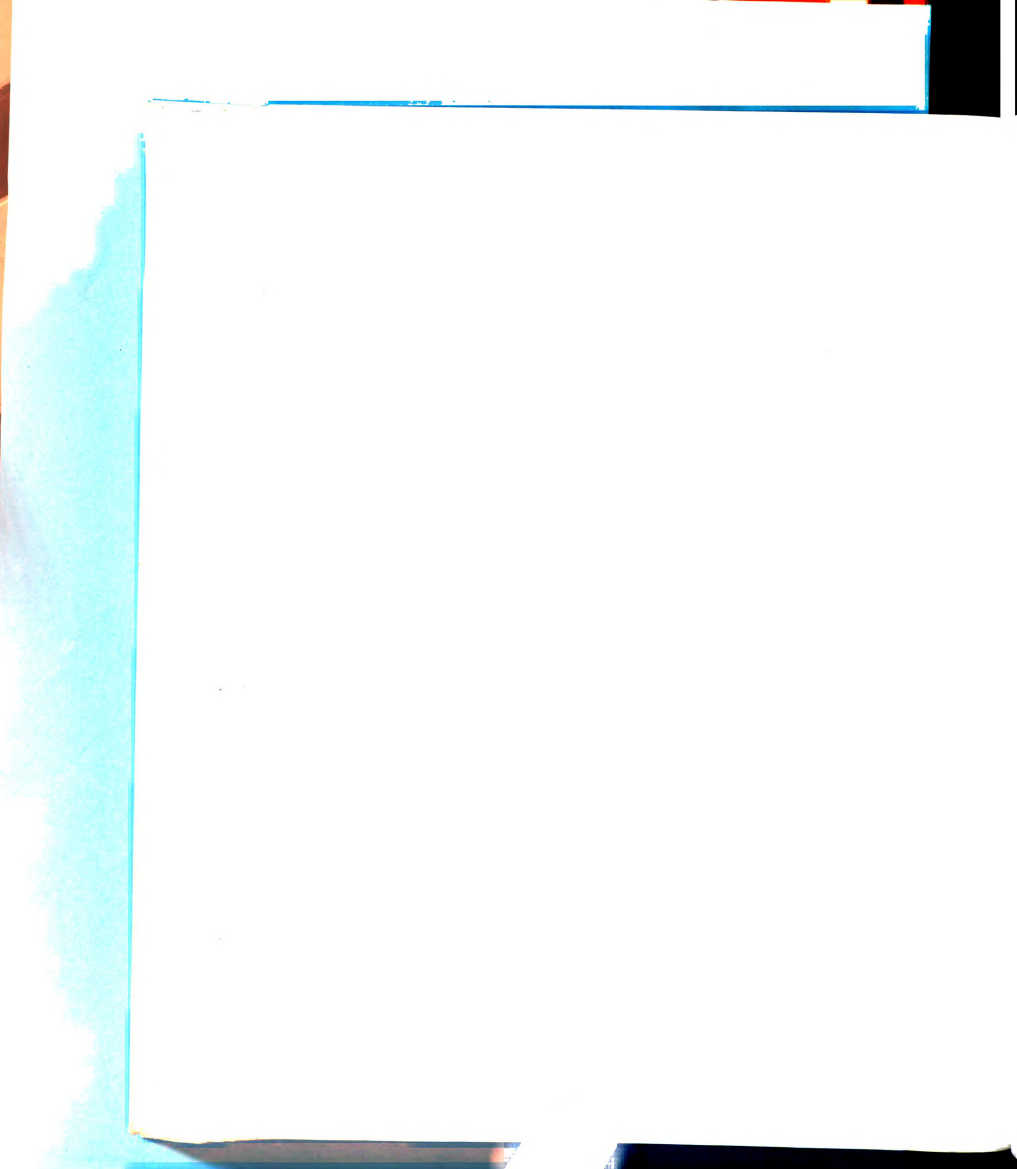
Chemical Bank New York Trust Company. International Economic Survey: Nigeria, 1961), 4.

Cooper, Philip L. "Scientific Integration, A Proposal." American Biology Teacher, XXVII, 1 (January, 1965), 44-45.

Craig, Gerald S. "Children and Science." Science Education, XL, 3 (April, 1956), 167-179.

Deakin, J. "Changes in Examinations for West African Secondary Schools." West African Journal of Education, VIII, 2 (June, 1964), 71.

Elgood, John. "Secondary School Biology in West Africa." West African Journal of Education, I, 1 (February, 1957), 24.



Foreign Education Digest, (January-March, 1963), 224-228.

Haggis, Sheila M. "Original Work in Science Teaching." West African Journal of Education, III, 3 (October, 1959), 102-103.

Hale, Helen E. "Developing an Articulated Science Curriculum." The Science Teacher, XXXIII, 4 (1966), 9.

Jelliffe, D. B. "Clinical Rickets in Ibadan, Nigeria." Journal of Tropical Medicine and Hygiene, XLV, 1 (August, 1951), 119-124.

McLaughlin, John. "Report from Biafra." America, CXX, 4 (January 25, 1965), 90-91.

Moore, Hollis A. "Nigeria Looks to Schools to Better Living Conditions." The Nations Schools, LIII, 3 (March, 1954), 74.

Morgan, D. "Modernization of Secondary Level Curricula and the Teaching of Biological Sciences." West African Journal of Education, XI, 1 (February, 1967), 11.

Nicol, B. M. "The Nutrition of Nigerian Peasant Farmers, with Special Reference to the Effects of Vitamin A and Riboflavin Deficiency." British Journal of Nutrition, III (1949), 41.

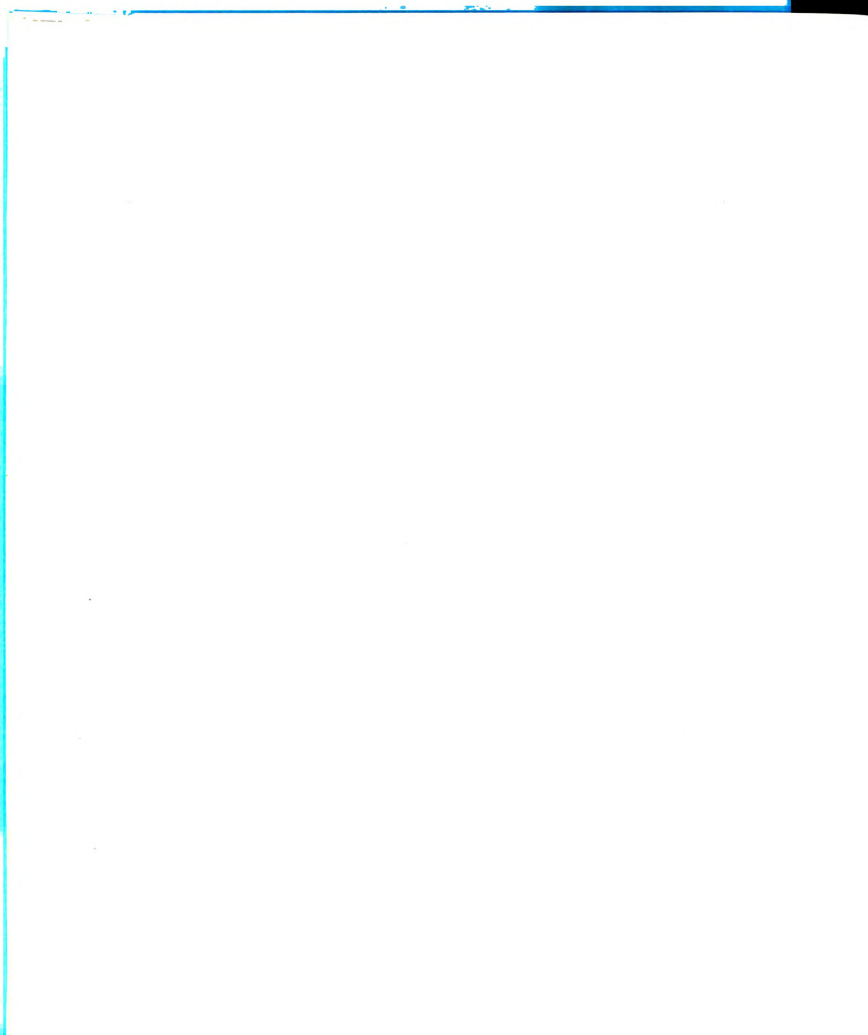
_____. "The Nutrition of Nigerian Peasants, with Special Reference to the Effects of Deficiencies of the Vitamin B Complex, Vitamin A and Animal Protein." British Journal of Nutrition, VI (1952), 53-54.

Perrodin, Alex F. "Children's Interest and Elementary School Science." School Science and Math, LXV, 3 (March, 1965), 259-264.

Post, K. W. J. "Nigeria Two Years After Independence." The World Today (December, 1962), 254.

Ruchlis, Hy. "An Experience with the Methods of Science." Science and Children, I, 2 (October, 1963), 16.

Schumm, Ruth. "Blackboard in the Jungle." The Science Teacher, XXXII, 7 (October, 1965), 40.



Shamos, Morris H. "The Role of Major Conceptual Schemes in Science Education." The Science Teacher, XXXIII, 1 (January, 1966), 28.

Shepherd, Jack. "Memo from Nigeria: Old Headache for Our New President." Look, XXXII, 24 (November 26, 1968), 74.

Silvera, W. D. and D. B. Jelliffe. "Liver Biopsies in Nigerian Children." Journal of Tropical Medicine and Hygiene, LV (1952), 78-79.

Trade Directory of the Federal Republic of Nigeria, 1963-64. London: Diplomatic Press and Publishing Company.

Uselton, Horace W.; Joseph C. Bledsoe; and Charles L. Koelsche. "Factors Related to Competence in Science of Prospective Elementary Teachers." Science Education, XLVII, 5 (December, 1963), 508.

Walsh, William J. "Science Equipment Storage." Science and Children, I, 5 (February, 1964), 10.

Weaver, Edward K. "Science Education in Nigeria." Science Education, XLVIII, 4 (October, 1964), 352.

Welch, A. T. "The Use of the Motor-Vehicle in Illustrating Basic Scientific Principles." West African Journal of Education, II, 2 (1958), 64.

Wilson, J. Y. "Field Studies in School Biology." West African Journal of Education, III, 1 (February, 1959), 14.

Reports

British Information Services. Nigeria: The Making of a Nation, June, 1960.

Colonial Annual Reports, Nigeria 1952. Her Majesty's Stationary Office, London, 1954.

Education and World Affairs Committee on Education and Human Resource Development. Education and Human Resource Development and Utilization in Nigeria. New York, 1967.

_____. Education, Training, and Employment in Nigeria. New York, 1967.

Education and World Affairs Committee on Education and Human Resource Development. Analysis of Human Resource Development and Utilization in Nigeria. New York, 1967.

The Education Ordinance. No. 15, Nigeria, 1926.

Federal Ministry of Information. University Development in Nigeria. Report of the National Universities Commission. Lagos, 1963.

Federal Nigeria Independence Supplement. Nigeria, 1961.

Federation of Nigeria. Educational Development in Nigeria 1961-70. Lagos, Nigeria, 1961.

. Federal Government Development Programme 1962-1968 (Sessional Paper No. 1 of 1962).
Lagos Federal Government.

. Annual Report on the Medical Services of the Federal Territory of Lagos for the Year 1957.
Lagos: Federal Government, 1958.

. Federal Government Development Programme 1962-63. Lagos: Federal Government.

The Government Syllabus for Elementary Schools. Nigeria, 1931.

Investment in Education, Report of the Commission on Post School Certificate and Higher Education in Nigeria, 1960.

McHoney, Christopher. A Survey-Study of Existing Secondary-Grammar School Education in Nigeria in Comparison with the U. S. System, 1961.

Ministry of Education. Syllabus for the Primary Schools, 1955.

Nathan, Robert R., Associates, Inc. Indigenous Industry in Nigeria. Washington, D. C., 1964.

Plan for a University of Nigeria, Enugu, 1959.

UNESCO. World Survey of Education, U. K., Territories (West Africa): Federation of Nigeria, 1960.

The West African Examinations Council. School Examinations in West Africa, A Statistical Summary, 1959.



The West African Examinations Council. The West African General Certificate of Education and School Certificate, Regulations and Syllabuses, 1967.

World Confederation of Organizations of the Teaching Profession. Appendix to the Report of the First Meeting of the Exploratory Commission on Educational Policy for Africa, 1959.

Unpublished Material

Okala, J. B. C. "Education and Cultural Dynamics with Particular Reference to an African Kingdom." Unpublished Ph.D. dissertation, Columbia University, 1953.

APPENDIX

100

THE SYLLABUSES FOR THE WEST AFRICAN GENERAL
CERTIFICATE OF EDUCATION AND SCHOOL
CERTIFICATE EXAMINATIONS IN BIOLOGY,
CHEMISTRY AND PHYSICS

Biology¹

Detailed Syllabus

Although the special animal and plant studies required are set out in separate portions of the syllabus it is assumed that they will be integrated by frequent cross-reference and comparison in the teaching.

The interdependence and unity of life should be emphasized throughout. The differences should be noted between living and non-living matter and between plants and animals.

Not only is a knowledge of the structure and physiology of animals and plants in the schedule required but consideration of their natural history and ecology is also essential, and evidence of this approach will be expected in the written answers. Personal observations on living organisms should be made wherever

¹The West African Examinations Council, The West African General Certificate of Education and School Certificate, Regulations and Syllabuses, 1967, pp. 37-45.

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possible. Great importance should be attached to experimental work and the use of control experiments. When the cellular structure of particular animal or plant organs is being considered this should, wherever possible, be demonstrated by means of the microscope or a microprojector. For most purposes a hand lens is sufficient; detailed knowledge of cell structure will not be required except where specifically indicated in the syllabus.

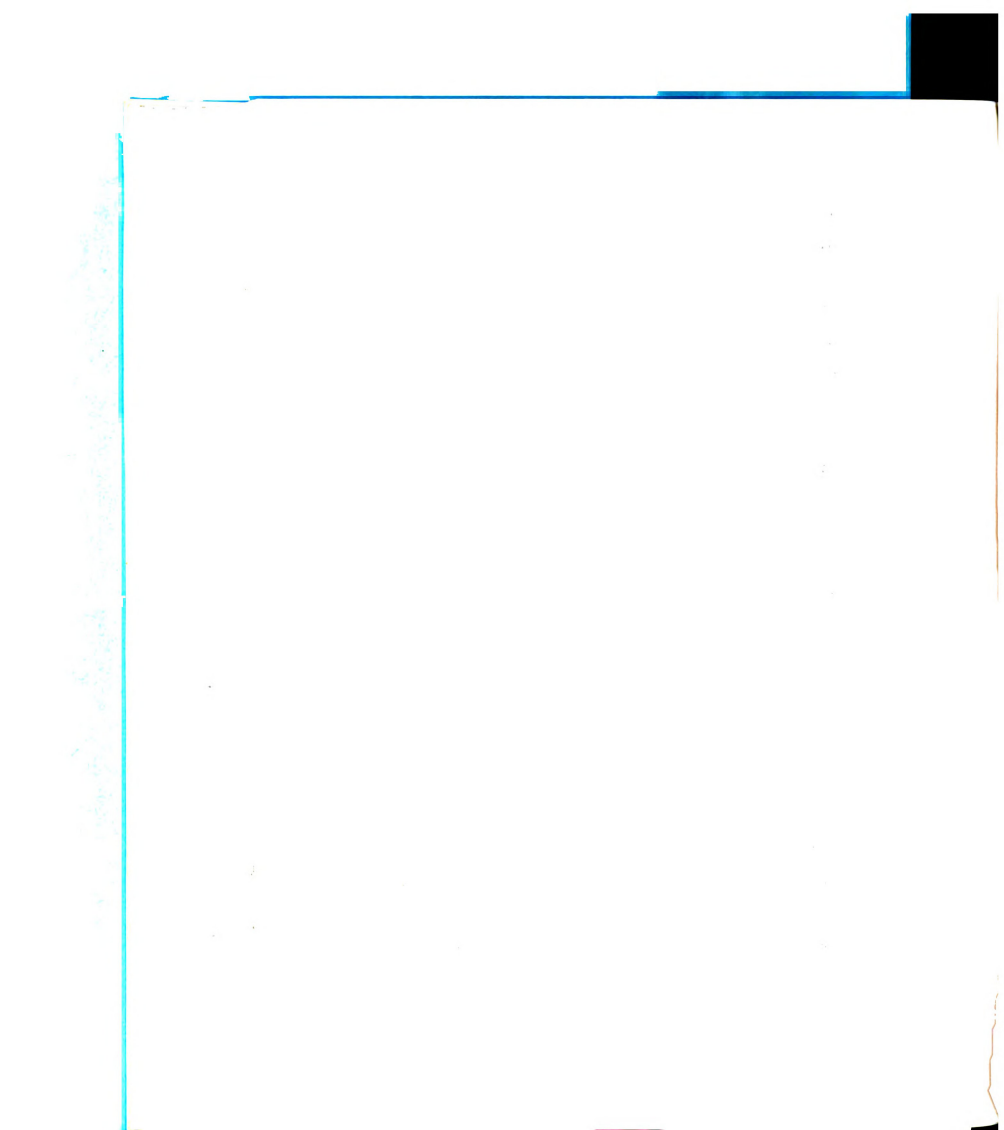
No questions will be set on evolution but the idea of evolution should be introduced and illustrated at relevant points in the course. It is hoped that teachers will at least outline the evidences for evolution from the occurrence of fossils and very simple morphology. In the same way, the general discussion of reproduction should include brief reference to the facts of heredity, although no questions will be set on the laws of inheritance. Candidates will be expected to answer questions on the topics set out in the section headed "Syllabus."

Syllabus

1. The Mammal

The general elementary structure and physiology of a mammal.

(a) The main structural features of a mammal including the general arrangement of the internal organs. External features in relation to habits and environment.



(b) The general plan of the skeleton and its functions. Different types of joints as illustrated by the shoulder, hip and elbow and the way muscles act on bones to cause movement. The structure and function of vertebrae: atlas, axis, cervical, thoracic and lumbar vertebrae.

(c) The structure of a tooth and its insertion in the jaw-bone. Incisors, canines, premolars and molars. The relation of dentition to diet as illustrated by man, a herbivore and a carnivore.

(d) The alimentary canal. Food substances and diet. Digestion, including the functions of the liver and pancreas. Absorption, transport and utilization of digested food. The function of the liver in the general body metabolism.

(e) The main features of the circulatory system. The structure of the heart. Structure and functions of the blood. Capillary circulation. Lymph.

(f) Respiration. The respiratory organs and the mechanism of breathing. Tissue respiration. The role of oxygen in the liberation of energy for the activities of the living body.

(g) Excretion by kidneys, sweat glands, lungs. Elementary treatment of the structure of the kidney and of filtration and reabsorption.

(h) Structure and functions of the skin.

(i) Regulation of body temperature and the importance of the maintenance of a constant body temperature.

(j) A simplified account of the brain and spinal cord. Reflex action and how it differs from voluntary action. The principal sense organs, their position and function. The structure of the eye and ear simply treated. The use of spectacles for the correction of long sight and short sight.

(k) The coordination of the body functions by means of the hormones, thyroxin, adrenalin and insulin.

(l) The reproductive organs and a general outline of the development, nutrition and respiration of the embryo. Birth.

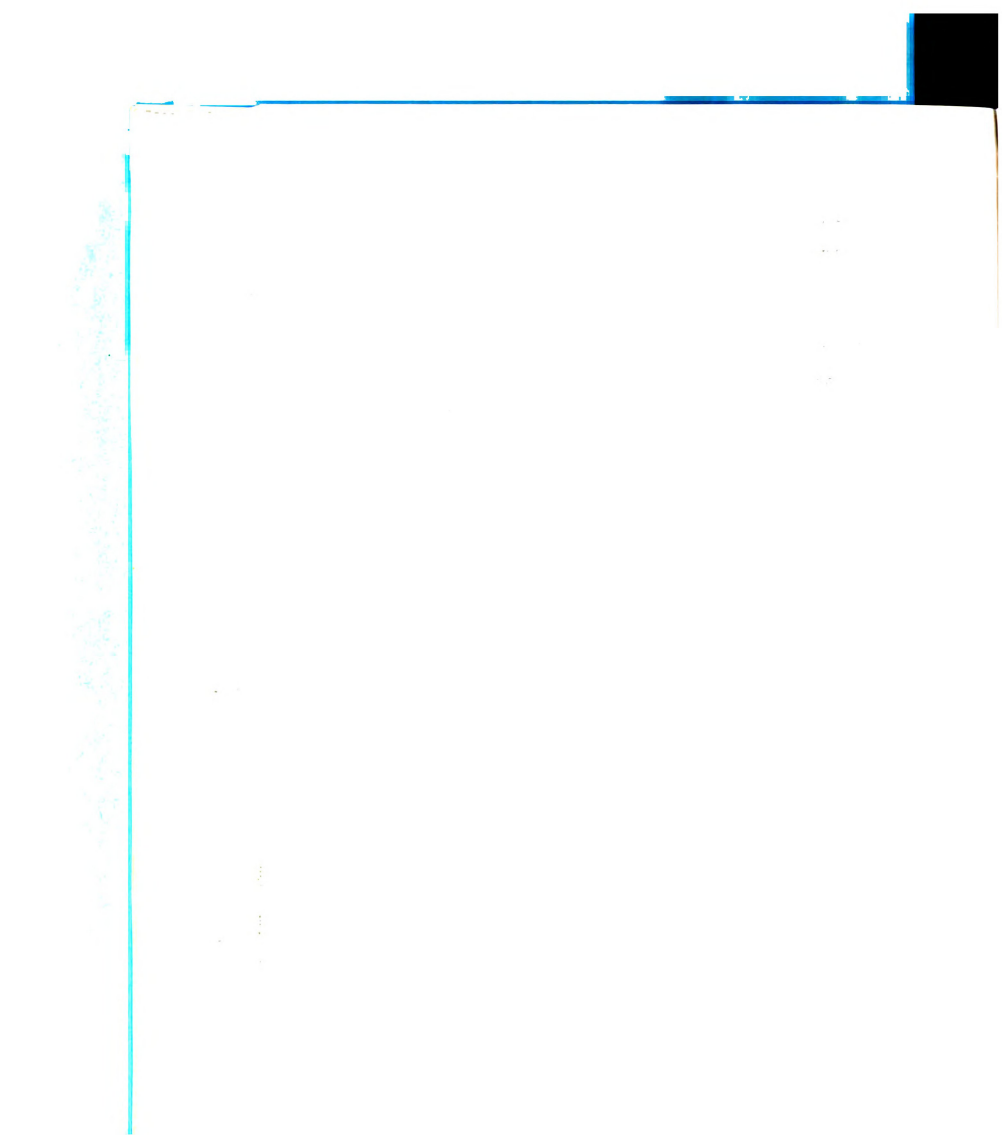
2. Other Vertebrates

(a) External features, habits, movements and life-history of a fish (including gills), a toad or a frog, a lizard, a bird and a small mammal.

(b) Development of the toad or frog from fertilization to complete metamorphosis.

3. Insects

The general characteristics of insects as illustrated by a study of the external features of a cockroach or grasshopper or locust.



The outline of the life-history of two insects chosen from the groups (a), (b), (c), (d), (e), (f), and (g) below, one to illustrate complete metamorphosis and the other incomplete metamorphosis.

The mode of life and economic importance (if any) of one insect chosen from each of five of the groups (a)-(g) below:

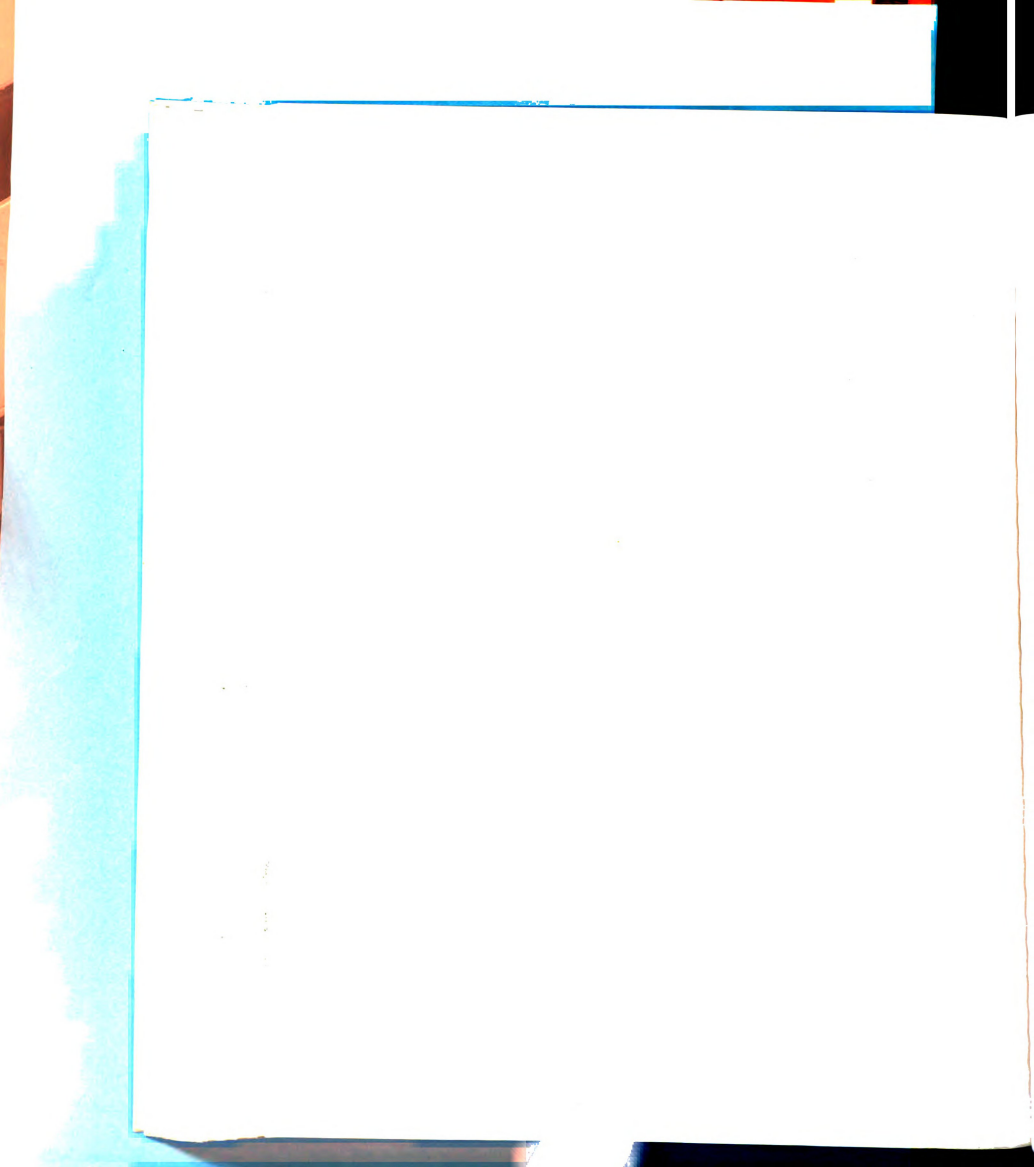
- (a) cockroach or grasshopper or locust;
- (b) mosquito or gnat;
- (c) blowfly or housefly or tsetse;
- (d) a lepidopteran (butterfly or moth);
- (e) a plant-sucking insect (e.g., greenfly or scale insect or cotton stainer--*Dysdercus* spp.) or a bed bug;
- (f) a social insect, e.g., honey bee or ant or termite;
- (g) a weevil or other beetle.

4. Intestinal Worms

The study of the external features and life-history of any one intestinal worm, e.g., tapeworm (*Taenia*), common round worm (*Ascaris*).

5. Microscopic Organisms

The organisms studied in this section are intended to introduce the student to the cellular theory of life and to the idea of cell specialization.



(a) Microscopic animals. The microscopic appearance and movements of Amoeba (or Paramecium, excluding details of conjugation), including an elementary knowledge of their methods of nutrition and reproduction.

Any free-living holozoic protozoon may be substituted for Amoeba, e.g., Paramecium, Spirostomum.

(b) Bacteria.

(c) Microscopic Plants. Structure, nutrition and life-history of (i) Spirogyra or other green filamentous alga (e.g., Zygnema), (ii) Mucor or Rhizopus, or Penicillium.

(d) A brief mention of Euglena as an example of an organism sharing the characteristics of plants and animals.

6. Flowering Plants

(a) An outline of the external morphology of a named herbaceous dicotyledonous plant.

(b) General morphology, including leaf fall, and flowering and fruiting cycles, of two readily available trees of which one should be a palm.

(c) Stem, leaf and root to be treated with reference to their functions and to experiments in Plant physiology.

The internal structure of stem, leaf and root.

(d) The parts of a flower and their functions.

The mechanism and means of pollination of a wind-pollinated flower (e.g., grass, maize, sugarcane) and any two large insect-pollinated flowers. Fertilization and the development of fruits.

(e) Fruit and seed dispersal.

(f) The structure and germination of seeds.

(g) Herbaceous perennials illustrating different types of storage organs and vegetative reproduction.

(h) A study of the development and methods of cultivation of one of the following crop plants: maize, Guinea corn, millet, rice, cotton, sugarcane, groundnut, tobacco, banana (or plantain), cassava.

7. Plant Physiology

(a) The processes of diffusion and osmosis. The absorption of water and mineral salts. The importance of turgor.

Water or sand cultures.

(b) The rise of water up the xylem vessels.

(c) The process of transpiration.

(d) Photosynthesis: the nature of the process itself and the translocation and use of the manufactured food. The great importance of photosynthesis to life in general.

(e) Respiration: the nature of the process and its significance in other vital activities. The carbon cycle and energy exchange.

Anaerobic respiration and yeast fermentation.

(f) Growth and its relations to external stimuli. Tropisms and sleep movements.

(g) Conditions for seed germination and further conditions for subsequent healthy growth of seedlings into mature plants.

(h) Soils, their constituents and characteristics. Structure and porosity of soils. Water movement in soil. Ways in which soils lose fertility: (i) loss of organic matter (humus) due to high temperature with exposure to direct sunshine, (ii) leaching, surface compacting (reduction of aeration). Soil erosion: sheet and gully erosion due to heavy rainfall; other forms of erosion, e.g., by wind and sea. Prevention of soil erosion by vegetative protection and shade and by contouring of sloping ground, terracing, etc.

(i) Means of conserving and renewing soil fertility; role of organic matter in tropical soils. The nitrogen cycle including the living organisms which play a part in it.

Manuring. Use of fertilizers, shifting cultivation and rotation of crops.

Ecology

The relation of plants and animals to their environment based on studies of one example of one of the following types of habitat:

- (a) an aquatic habitat;
- (b) a terrestrial habitat;
- (c) an arboreal habitat.

9. General Principles

Some of the questions will assume a knowledge of the subject-matter of the following paragraphs, but direct questions on the more general principles will be avoided:

- (a) Nutrition, including a brief treatment of saprophytism, parasitism and symbiosis.
- (b) Food chains.
- (c) Cell structure of plants and animals demonstrated by means of a microscope or a microprojector. Cell wall, nucleus and cytoplasm for one simple cell. Elementary notion of cell differentiation in association with function illustrated by reference to some of the different types of cell present in different organs or tissues.

Practical Biology

Two hours will be allowed for this test, which can be taken in an ordinary classroom, and which will contain questions on the biology of both plants and

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animals. The principal aim will be to test skill in biological observation. The material set will be closely related to the subject-matter of the syllabus, but will not necessarily be limited to the particular types mentioned therein. Each candidate will need a hand-lens (at least x5), a sharp penknife or scalpel and two mounted needles.

Syllabus

(a) Vertebrates

(i) Mammalian skeleton. The following bones may be set: vertebrae, humerus, femur, scapula and pelvic girdle.

(ii) Feathers: quills and down.

(iii) An amphibian tadpole, e.g., toad or frog tadpoles.

(iv) A small teleost fish.

(b) Invertebrates

(i) A typical insect, e.g., cockroach or locust or grasshopper.

(ii) Stages in the life-history of insects.

(iii) External features of one other type of antropod: spider or centipede or a crustacean.

(iv) External features of a mollusc (e.g., snail or slug or mussel) or an annelid (e.g., earthworm or marine worm or leech).

Chemistry²Detailed Syllabus

1. The concept of atoms and molecules; Dalton's Atomic Theory; atomic structure treated simply; neutrons, protons, electrons and their arrangement in shells (omitting details or orbitals); atomic number, electrovalency and covalency illustrated by reference to the first twenty elements of the periodic classification.

2. The kinetic theory of matter (qualitative treatment) and its application to solids, liquids and gases. Qualitative explanation of the following in terms of the kinetic theory: changes of state, Boyle's law, Charles's law.

3. Pure substances (elements and compounds), mixtures. Chemical change and physical change. Methods of separation of mixtures, evaporation, distillation, fractional distillation, sublimation, filtration, crystallization, precipitation, and the use of these processes in preparing pure substances. Properties of suspensions.

Alloys: steel, brass, type-metal, duralumin and soft solder; the simpler reasons for the use of these alloys in preference to the metals from which they are made.

²Ibid., pp. 46-50.

2. The second part of the document addresses the challenges associated with data management and analysis. It highlights the need for skilled personnel who can effectively interpret large volumes of data and extract meaningful insights. The text also mentions the importance of regular data audits to identify and rectify any discrepancies or errors, ensuring the integrity of the information used for decision-making.

3. The third part of the document focuses on the role of technology in enhancing data management processes. It discusses various software solutions and tools that can streamline data collection, storage, and analysis. The text notes that while technology offers significant advantages, it also requires careful implementation and ongoing maintenance to ensure it remains effective and secure.

4. The fourth part of the document explores the ethical considerations surrounding data management. It stresses the importance of protecting personal information and ensuring that data is used only for its intended purpose. The text also mentions the need for clear policies and procedures regarding data access and sharing, to prevent misuse and maintain trust with stakeholders.

5. The fifth part of the document provides a summary of the key points discussed and offers recommendations for best practices. It encourages organizations to adopt a proactive approach to data management, regularly reviewing and updating their systems and policies to stay current with evolving standards and regulations.

6. The sixth part of the document includes a list of references and sources used in the research. It cites several academic papers, industry reports, and government publications that provide further context and support for the findings presented in the document.

7. The seventh part of the document contains a list of appendices, which include additional data, charts, and supplementary information. These appendices are provided to support the main text and offer a more detailed look at the data and analysis presented.

8. The eighth part of the document is a conclusion that summarizes the overall findings and reiterates the importance of effective data management. It states that while there are many challenges, the benefits of proper data management are significant, and organizations should strive to implement the best practices outlined in the document.

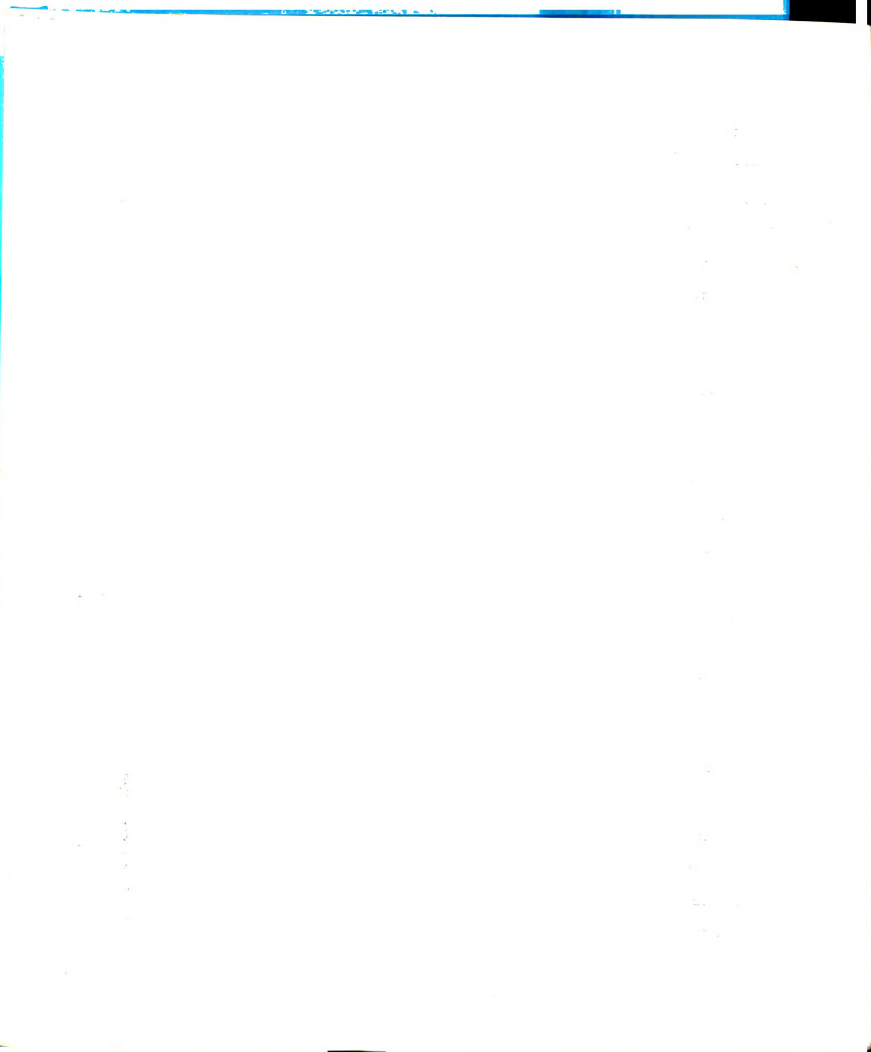
9. The ninth part of the document is a list of acknowledgments, thanking the individuals and organizations that provided support and assistance during the research process. It also includes a list of authors and their affiliations.

10. The tenth part of the document is a list of footnotes, providing additional information and references for the sources cited in the text. It includes details about the research methodology and any limitations of the study.

4. Law of conservation of mass, law of definite proportions, law of multiple proportions; chemical formulae (simple calculations involving formulae and chemical composition), chemical equations and their use insofar as they assist in giving a mental picture of chemical action. Simple calculations from equations of reacting weights of substances and volumes of gases. Equivalent weights and methods of their determination. Valency. Atomic weights. (Mention should be made of atomic weight based on $^{12}\text{C} = 12$. Methods of determination of atomic weights will not be required.) The equivalent weights of simple acids and alkalis and the use of standard solutions of acids and alkalis.

5. The study of gases. The laws of Boyle, Charles, Graham, Dalton (law of partial pressures), Gay-Lussac and Avogadro. Grammolecular volume; Avogadro's Number, atomicity of gases. The relation between the vapour density of a gas and its molecular weight. Simple calculations based on these laws.

6. The air and its chief gaseous constituents including oxygen, nitrogen, water vapour, carbon dioxide and a brief mention of argon and neon; proportion of oxygen in air (e.g., by burning phosphorus or by using alkaline pyrogallol). Significance of the difference between the density of nitrogen from air and of nitrogen from a nitrogen compound.



7. Water, composition by volume. Water as a solvent. The use of other solvents for fats, oils, paints, and for cleaning. Saturated and unsaturated solutions; the determination of solubilities of solids; solubility curves and simple deductions from them. Atmospheric gases dissolved in water; their biological significance. Hard and soft water; temporary and permanent hardness; the methods of softening hard water; hydration. Methods of purification of town water supplies. Efflorescent deliquescent and hygroscopic substances.

8. General characteristics and properties of acids, bases and salts. Ionic reactions; acids, alkalis and salts treated from the ionic aspect, basicity of acids, normal salts, acid salts, double salts.

Association of ions, e.g., precipitation of silver chloride, reaction of H^+ with OH^- and with $CO_3^{=}$. Preparation of salts by neutralization, precipitation and action of acids on metals, oxides and carbonates.

9. Electrolytes, non-electrolytes, electrolytic dissociation. Simple study of electrolysis; electrolysis of acidulated water (dilute sulphuric acid), of simple salt solutions, e.g., cupric chloride; electrolysis of copper sulphate solution using copper, platinum or carbon electrodes (with subsequent electrolysis of the dilute sulphuric acid).

Faraday's laws and calculations based on them.

The use of electrolysis in the purification of copper; copper-plating.

10. The physical and chemical difference between metallic and non-metallic elements. The activity series (K, Na, Ca, Mg, Al, Zn, Fe, Pb, H, Cu, Hg, Ag, Au) illustrated where practicable by chemical properties including reaction of the metals with water and acids, replacement of one metal by another and stability of the oxides, carbonates and nitrates.

11. The study of the following elements and their compounds:

I. Metals

(1) Sodium. Properties and uses. Sodium hydroxide: production by electrolysis of brine; its action on aluminum and zinc; uses, including precipitation of metallic hydroxides. Sodium carbonate and sodium bicarbonate: properties and uses, production by Solvay Process. Sodium chloride: its occurrence in sea water, uses.

(2) Calcium. Calcium oxide, calcium hydroxide, calcium carbonate: properties and uses.

(3) Aluminum. Electrolytic extraction, properties and uses.

(4) Iron. Extraction, properties and uses.

Rusting of iron as slow oxidation and the protection of metals from corrosion.

(5) Copper. Properties and uses. Copper sulphate: uses.

II. Non-Metals

(1) Oxygen. Preparation, properties and uses; commercial production from liquid air.

(2) Hydrogen. Preparation, properties and uses; production from water gas.

(3) Nitrogen. (a) Manufacture from liquid air.

(b) Ammonia. Laboratory preparation, and industrial preparation (Haber Process); properties and uses.

Ammonium salts, importance and uses. Oxidation of ammonia to nitric oxide and nitric acid. (c) Nitric Acid. Laboratory preparation, industrial preparation from ammonia, its reactions as an acid and as an oxidizing agent, uses. Nitrates: action of heat on nitrates; uses of nitrates including fertilizers. Nitrous oxide, nitric oxide, nitrogen dioxide; properties. The nitrogen cycle.

(4) Sulphur. (a) Allotropes, extraction by Frasch Process; uses. Sulphur dioxide, preparation from a sulphite, properties and uses. (b) Sulphuric Acid. Commercial preparation (contact process); uses; properties as a dilute acid and as an oxidizing and dehydrating agent. Sulphates and bisulphates; uses. (c) Hydrogen

Sulphide. Preparation, properties as a weak acid, reducing agent and precipitating agent.

(5) Chlorine. Laboratory preparation, industrial preparation by electrolysis of brine, properties. Uses of bleaching powder and sodium hypochlorite.

Hydrochloric acid: preparation and properties; chlorides.

(6) Carbon. (a) Allotropes: various forms of carbon such as diamond, graphite, decolourizing charcoal, lampblack. (b) Carbon Dioxide. Laboratory preparation, properties and uses. Action of heat on carbonates and bicarbonates. (c) Carbon Monoxide. Laboratory preparation, properties including its effect on blood. Charcoal fires.

(7) Organic Chemistry. Carbon--carbon compounds

(a) Hydrocarbons.

(i) Alkanes (paraffins), general formula, homologous series in relation to physical properties. Isomers, e.g., iso-butane.

(ii) Alkenes, general formula. Example: ethylene--polymerization, e.g., formation of polythene; hydrogenation, e.g., conversion of ethylene to ethane.

(iii) Alkynes, e.g., acetylene production from action of water on carbides. Use for lamps and welding.

(iv) Petroleum and its refining including fractional distillation of crude oil; the study of

fractionation and cracking treated simply; the use of the fractions.

(b) Alcohols. General formula; examples: methanol, ethanol, methylated spirit; production of ethanol by fermentation.

(c) Organic acids. General formula, e.g., formic acid; acetic acid as a product of bacterial decay.

(d) Esters. Formation from acid and alcohol. Fats and oils as esters. Production of soap and margarine.

(e) Carbohydrates. Simple sugars, e.g., glucose and fructose; complex sugars, e.g., sucrose. Starch.

(f) Destructive Distillation of Coal. Products obtained. Combustion of carbon and carbon-containing substances in (a) plentiful, and (b) limited, supplies of air. Energy changes in combustion, energy relationship in the processes of photosynthesis and respiration; carbon cycle. The candle flame. The Bunsen burner and its flames.

(8) Oxidation in terms of addition of oxygen or removal of hydrogen, reduction as removal of oxygen or addition of hydrogen. Oxidation and reduction extended to a change in valency; tests for oxidizing and reducing agents; acidic, basic, amphoteric and neutral oxides.

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Types of chemical change including reversible reactions; catalysts and their importance.

Practical Chemistry

Candidates may be asked to observe the effects of heat and of reagents on substances supplied to them. Simple exercises in observation and experiments may include the recognition of the gases: hydrogen, oxygen, carbon dioxide, chlorine, hydrogen chloride, hydrogen sulphide, sulphur dioxide, ammonia, nitrogen dioxide, water vapour; identification by simple valid tests of the anions: nitrate, chloride, carbonate, sulphate, sulphide, and of the cations: ammonium, lead, copper, iron, zinc, calcium. Knowledge of a formal scheme of analysis is not required.

Volumetric analysis: the use of standard solutions of acids and alkalis and the indicators methyl orange (or screened methyl orange) and phenolphthalein (a) in determining (i) the concentration of acidic and alkaline solutions (such as sodium hydroxide, sodium carbonate or sodium bicarbonate), and (ii) the equivalent weights of acids and alkalis by direct titration; and (b) in simple exercises to test a knowledge of the principles of volumetric analysis. Back titrations will not be required and calculations may be worked either from normalities or from reacting weights. Candidates will not be expected, in the examination, to prepare their own standard solutions.



Physics³Detailed Syllabus

Symbols to be used in Electricity and Magnetism questions. The symbols, names of units and of physical quantities used should be those which are easily available to the schools.

Syllabus

1. Measurement of length and of volume.
2. Measurement of time by use of the simple pendulum.
3. Densities and specific gravities of solids and liquids.
4. Pressure in liquids and gases; transmission of fluid pressure; the hydraulic press.
5. Boyle's Law.
6. Mercury and aneroid barometers.
7. Bicycle pump, force pumps and lift pumps.
- The siphon.
8. Principle of Archimedes.
9. Flotation: the common hydrometer.
10. Simple ideas of force producing movement and acceleration. Inertia.
11. Levers: Principle of moments. The common balance. Wheel and axle.

³Ibid., pp. 121-127.

12. Velocity ratio, mechanical advantage and efficiency of machine.

13. Centre of gravity treated experimentally. Its relation to stability of equilibrium.

14. Hooke's Law: elastic limit.

15. Simple experiments on friction, including a determination of the coefficients.

16. Work, energy, power; the transformation and conservation of energy applied to the quantitative conversion of energy into its different forms (mechanical, electrical, thermal).

17. Vector quantities; the resolution and composition of inclined velocities and forces.

18. Problems involving the equilibrium of three non-parallel forces.

19. Velocity and acceleration; the equations of uniformly accelerated motion.

20. Force, inertia, mass.

21. Simple phenomena of surface tension, capillarity, viscosity and diffusion.

22. Mercury and alcohol thermometers. Centigrade scale.

23. Thermal expansion of solids, liquids and gases. Effects and applications of expansion.

24. Determination of the coefficient of linear expansion.

25. Relation between volume and temperature of a gas.

26. Absolute temperature; the gas equation $\frac{pv}{T} = \text{constant}$.

27. Quantity of heat; calorie; specific heat; water equivalent; meaning of calorific values of fuels and food-stuffs.

28. Determination of specific heats of solids and liquids.

29. Change of state; evaporation and boiling; latent heats of fusion and vaporization.

30. Boiling-points and melting-points and the influence of pressure and of dissolved substances on them.

31. Saturated and unsaturated vapours; vapour pressure.

32. Relation of saturated vapour pressure to boiling-point.

33. Dew-point and its determination by a simple method; the simple atmospheric phenomena related to it.

34. Simple qualitative treatment of kinetic theory.

35. Heat as a form of energy.

36. Conversion of heat into work.

37. Transfer of thermal energy by conduction, convection and radiation.

38. Effect of nature of a surface on the energy radiated and absorbed by it.

39. Rectilinear propagation of light; shadows, eclipses.

40. Reflexion of light; formation of images by plane and curved mirrors; relation of angle of incidence to angle of reflexion.

41. Refraction at a plane surface; laws of refraction (Snell's Law); refractive index.

42. Total internal reflexion, including a qualitative treatment of critical angle.

43. Converging and diverging lenses; real and virtual images.

44. Focal length of a converging lens: graphical constructions and formulae connecting the positions and relative sizes of object and image for the converging lens.

45. The physics of the human eye; accommodation; long sight and short sight and their correction by spectacles.

46. The compound microscope and the astronomical refracting telescope, including the tracing of rays of light from a distant object to the observer's eye in such a way as to show the nature and positions of the images formed.

47. Simple experiments on the deviation and dispersion of light by a prism.

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48. Elementary treatment of the spectrum including the simple characteristics and uses of near infra-red, visible and near ultra-violet radiations.
49. Continuous and line emission spectra.
50. Simple absorption spectra; the colours of materials.
51. Mixing of coloured lights.
52. Production of sound by vibrating systems; its transmission in a material medium.
53. Determination of the velocity of sound by a simple method.
54. Reflexion of sound.
55. Frequency and its relation to pitch.
56. Frequency of note emitted by a stretched string in relation to length, tension and mass per unit length of the string; application to any stringed instrument.
57. Frequency of the note emitted by an air column closed at one end in relation to its length.
58. Quality of a musical note. Application to musical instruments.
59. Resonance. Application to musical instruments.
60. Simple phenomena of magnetism.
61. Magnetic properties of iron and steel.
62. The magnetic field of the earth.
63. Elementary electrostatics.
64. One good form of compass.

2. The second part outlines the procedures for handling financial data. It details the steps involved in collecting, processing, and analyzing financial information to ensure its reliability and accuracy.

3. The third part addresses the role of internal controls in preventing fraud and mismanagement. It describes how a robust system of internal controls can help identify and mitigate risks before they become significant issues.

4. The fourth part discusses the importance of regular audits and reviews. It explains how these processes can provide valuable insights into the organization's financial health and operational efficiency.

5. The fifth part covers the legal and regulatory requirements that govern financial reporting. It highlights the need for compliance with these requirements to avoid penalties and maintain the organization's reputation.

6. The sixth part discusses the importance of communication and collaboration between different departments. It stresses that effective communication is key to ensuring that all stakeholders are aligned and working towards the same goals.

7. The seventh part outlines the steps for implementing a new financial system. It provides a detailed roadmap for the transition, from initial planning to final implementation and evaluation.

8. The eighth part discusses the importance of ongoing training and development for staff. It emphasizes that continuous learning is essential for staying up-to-date with the latest financial practices and technologies.

9. The ninth part covers the importance of maintaining accurate and up-to-date financial records. It explains how this practice can help the organization make informed decisions and maintain its financial integrity.

10. The tenth part discusses the importance of regular communication and reporting to stakeholders. It highlights the need for transparency and accountability in all financial matters.

11. The eleventh part outlines the steps for conducting a financial review. It provides a structured approach to evaluating the organization's financial performance and identifying areas for improvement.

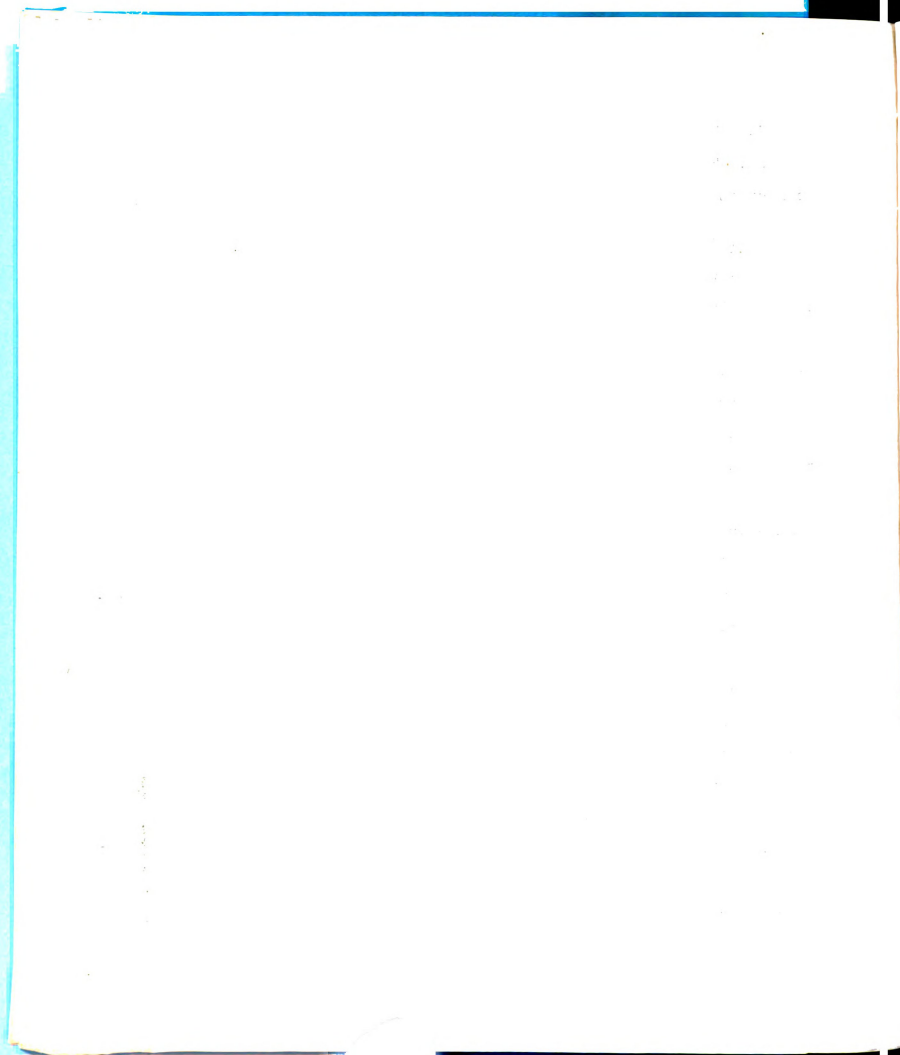
12. The twelfth part discusses the importance of maintaining accurate and up-to-date financial records. It explains how this practice can help the organization make informed decisions and maintain its financial integrity.

13. The thirteenth part covers the importance of regular communication and reporting to stakeholders. It highlights the need for transparency and accountability in all financial matters.

14. The fourteenth part outlines the steps for conducting a financial review. It provides a structured approach to evaluating the organization's financial performance and identifying areas for improvement.

15. The fifteenth part discusses the importance of maintaining accurate and up-to-date financial records. It explains how this practice can help the organization make informed decisions and maintain its financial integrity.

65. Simple voltaic cell; Leclanche cell (wet and dry). Daniell cell.
66. Accumulators.
67. The ampere; the coulomb; potential difference; electro-motive force; the volt; the watt, kilowatt and kilowatt hour.
68. The magnetic effect of an electric current.
69. Behavior of a coil carrying a current in a magnetic field; the D.C. motor; galvanometers and ammeters.
70. Ohm's Law; resistance; the ohm, resistivity. Internal resistance of cells.
71. Ammeter shunts; voltmeters.
72. Comparison of resistances by the metre bridge and of e.m.f.'s by the potentiometer.
73. The heating effect of an electric current.
74. The wiring of buildings; the use of switches and fuses.
75. The chemical effect of an electric current. Electrolytes and non-electrolytes. Faraday's laws. Electro-chemical equivalent and the measurement of current electrolytically.
76. Experiments to illustrate the phenomena of electro-magnetic induction; laws of electro-magnetic induction.
77. Alternating current; a simple A.C. generator; the transformer. The grid system of transmission of electrical energy.



78. The simple D.C. Generator.

79. Telephone transmitter and receiver, and their connections in a simple circuit.

Practical Physics

This will be tested by a Practical Examination based on the above syllabus except that there will be no questions on sound. The object of the practical examination is to test whether the candidates have worked through a satisfactory course in the laboratory and are capable of handling simple apparatus. The questions will, so far as possible, contain detailed instructions for all the operations to be performed. Even when standard experiments, such as the determination of focal lengths or specific heats are set, candidates will be told what readings to take and how to calculate the result. It should not, therefore, be necessary for candidates to learn by heart how to do any experiments.

In addition to experiments on topics in the syllabus, candidates may be asked to carry out with the aid of full instructions:

1. Variants on standard experiments, e.g., specific heats of two metals compared and not actually measured.

2. Experiments involving measurements where knowledge of the theory is not expected, e.g., bending of a metre ruler weighted at the center; heat evolved when two liquids are mixed; relative coefficient of

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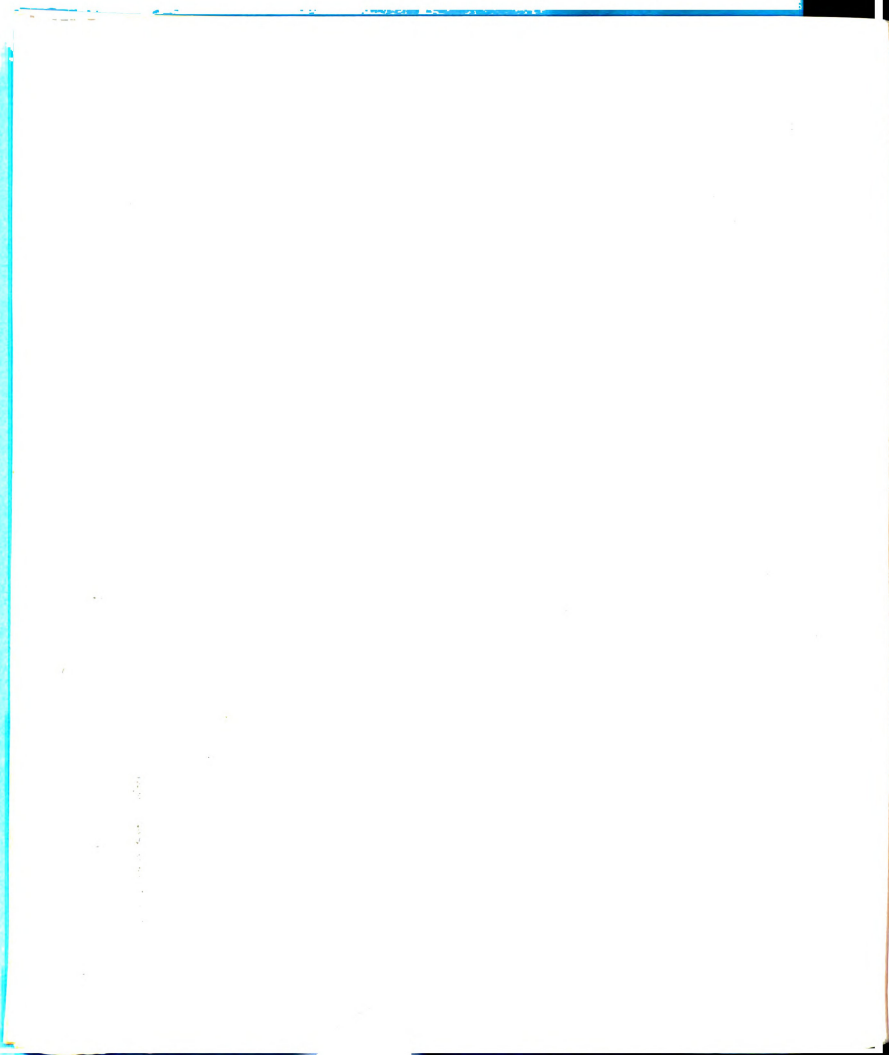
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expansion of liquid by specific-gravity bottle, location of real images applied to various simple determinations with spherical mirrors and lenses (either pin-and-parallax or light-box-and-screen methods are acceptable).

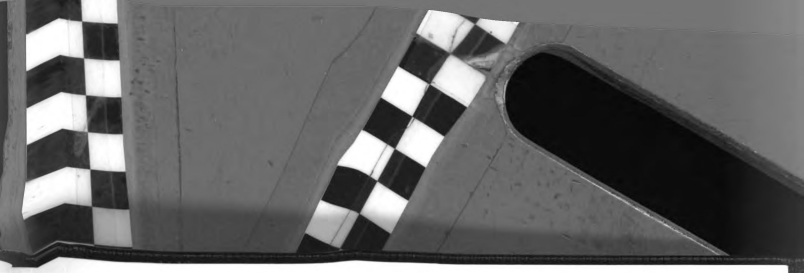
Questions may also be set involving measurements with a vernier and screw-gauge, the plotting of rays through prisms with pins, the plotting of magnetic fields by compass needle and location of neutral points.

The candidates should be trained to take as varied a set of readings as possible and to set out the actual observed readings systematically on one of the sheets of paper sent up. The experiments may require exhibition of results graphically and their interpretation. During the first ten minutes of the practical examination candidates will be allowed to see the apparatus, but not to start work. This time is intended to enable them to read through and choose their questions.

Questions on calorimetry will as far as possible contain alternatives for candidates trained to use thick calorimeter methods.













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