

# Comparative Issues and Data Concerning Science and Technical Education in Some African Countries

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## INTRODUCTION

Science Education in Africa does not aim specifically at developing a culture that would be indigenous or national in character. After all scientists and engineers the world over speak with one tongue. They communicate with one another in the technical language of their profession, a language born of industrialized society. No doubt, this language creates among its users, a community of interest and of spirit which makes for example the African scientist and engineer feel at home with his English or French counterpart.

Yet it has become abundantly clear to all countries in Africa that science, to be taught effectively, has to relate to local conditions and to cultural background. This duality of allegiance of African Science creates many problems in connection with the transfer of existing technologies from the industrialised countries, for indeed the scientific and technological options presented to the developing world have proved time and again to be too « foreign » for the people whom they affect.

Learning will take place effectively only if the appropriate learning experience is provided. An experience which is essentially vicarious in that it relates to other environments is educationally poor. For too long African schools have been subjected to illustrations and teaching materials belonging to a different culture and an environment foreign to Africa. We now know, it is not enough to seek to expand education if attention is not paid to the quality of the educational process. In most English and French-speaking African countries school enrolment figures have showed a remarkable increase over the period 1950-1970. In fact overall primary school figures rose nearly fourfold

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(\*) UNESCO, Regional Bureau for Education in Africa, Dakar. The views expressed in this paper are those of the author alone and not necessarily those of UNESCO.

during that period while secondary school figures were multiplied sevenfold. But, this remarkable numerical expansion only served to highlight the many defects and weaknesses of the system as expressed in the poor quality of the results, e.g. the alarming failure and drop-out rates. Thus the global figures show that only 32 % of those enrolled in the primary schools were able to finish their primary sixth year (figures quoted at the Nairobi Conference 1968). It has also served to underline the lack of relevance of formal education to the social and economic needs of the nation. In fact, quantitative expansion of the formal school system without profound qualitative changes is not in itself capable of solving the fundamental problem of providing a basic education for all. Science education has been valued as providing an exceptional tool for development. But like all education it is a basic process which bears fruit in the long term. In the short term steps must be taken to avoid the dangers of an overhasty modernization which can create social stresses and fails to promote harmonious social development.

The 1968 Nairobi international conference on education and scientific and technical training for development pinpointed some crucial areas which should receive the attention of educational planners.

1. Cooperation between scientific and technical education must be meaningful and integrated in the national development policy.
2. Primary science education should start from the scientific observation of the child's environment.
3. Great importance should be given to the development of scientific attitudes and of a problem-solving approach in science teaching.
4. As a pre-requisite to scientific and technical training, some knowledge of « technology » is recommended. The commission responsible for the recommendation after saying that substantial technology notions can be acquired by the child at the primary level already while playing with educational toys designed to stimulate creativity and imagination, went on to suggest the field for technology as a school subject thus : « It must not be confused either with the basic sciences which differ in method and in aims or with practical subjects currently found in certain schools consisting of metal work, wood-work, glass-blowing, modelling and pottery ».

#### *DIFFERENCES BETWEEN ANGLOPHONE AND FRANCOPHONE COUNTRIES*

All countries in the region are at various stages of searching for an effective educational system adapted to the needs of the people and geared to the greater and more embracing needs for national development. Whether English or French speaking all African states

have the common aim of promoting education for national development with the important corollary of *education for rural development*. The ultimate aim may be the same but the modalities and techniques for achieving this aim will be different. For, in effecting the change or the reform, instrument and procedures are used which must be adapted to the existing structures administrative or educational and to the people who will be using them.

A more theoretical and rigorous approach is usually associated with the French-speaking African countries. This is partly explained by the existing pattern of secondary education which has retained many of the characteristics of the French educational system. Thus the Baccalaureat courses which complete the secondary level of education are more broadly-based and more philosophically and theoretically oriented than the corresponding English Advanced Level or Higher School Certificates courses which may attain a degree of specialization only equalled in a first or even a 2nd year University course.

This is not to say that an experimental approach is excluded nor does it mean that a pragmatic attitude is never adopted. An example will illustrate the point. At a conference on Environmental Science Education held in Brazzaville in May 1975, participants who came from eight francophone countries were involved in a number of practical sessions during which activity classes and appropriate teaching techniques were demonstrated. These had very little dogmatic content. The impact on the participants was quite marked and the seminar went on to recommend that a Regional Office of SEPA (Science Education Programme for Africa) be set up in a francophone country in order to promote cooperation with English-speaking countries with greater experience in the new approach to Science Education.

The more centralized system which operates in educational administration in many French-speaking African States calls for different procedures. Such a system probably favours a vertical type of relationship up and down the hierarchical ladder rather than the more informal horizontal relation between peers, teachers of same disciplines etc. Because of that it may not really encourage small-scale experimentation at the grass-root level of the school and the classroom; however it may in fact be more effective in facilitating large-scale implementation of an innovation once this has been decided upon.

### *ISSUES IN SOME AFRICAN COUNTRIES*

As we have seen earlier, the problems in the educational field have prompted a search for relevance and quality in the context of national development. To achieve these goals a number of desirable objectives must be specified. The list would include the following :

1. Increase the number of qualified teachers,
2. Improve teacher training,
3. Adapt school to environment e.g. rural schools, community centres,

4. Improve teaching methods and techniques in order to reduce failure and drop-out rates,
5. Introduce primary school science via environmental studies,
6. Develop technical education and vocational training,
7. Integrate education with community and national development.

The last two issues are very relevant to a sound development policy in line with the exigencies of the modern technological world. These issues are far too complex to be solved by purely educational means. It is not possible to change the economic situation of people by curriculum changes alone. All relevant ministries must cooperate to make an organised attack on the problem.

However certain educational issues are prominent and have to be faced e.g. should basic education give a general technical education or should it deliberately concentrate on vocational training? The choice is complicated by the fact that truly vocational education is among the most expensive type of education there is and only prepares the recipient for a narrow set of skills. Also the inequality of opportunity which exists at the employment level between the academically trained and the vocationally trained may lead to a perpetuation of the social and economic dichotomy existing between the « academic » administrator and the technician.

But the wind of educational reform is blowing over Africa. Plans have been drawn up for curriculum reforms in many countries. These reforms are in various stages of preparation, experimentation and in some cases implementation.

### *Cameroon*

Three separate institutes are presently working in close liaison in the field of curriculum development. IPAR, Yaoundé (Institut de Pédagogie Appliquée à vocation Rurale) established in 1967 is devoted to primary education reforms in the francophone zone of the United Republic while IPAR Buea created in 1973 is concerned with reforms in primary education in the anglophone area. INE (Institut National d'Éducation) founded in 1973 is responsible for curriculum development and reform and deals with the whole national system.

IPAR Yaoundé has been training new rural teachers, working out new syllabi, producing school text-books which are being tried in 290 experimental classes. IPAR Buea is still in a first phase of two years devoted to the research and the study of the problems. A research programme in the fields of social studies, environmental studies, village technologies and language problems has been launched involving extensive surveys of existing educational and productive resources in the villages of the anglophone province. The report and suggestions should reach the government in 1976.

In the field of Technical and Vocational training, important projects on which work is proceeding include the following

- Setting up a National Centre of Permanent Vocational Training (CENEFOR). This Centre will be managed by an Administrative Board composed mainly of Industrialists and Representatives from the Private Sector. It is expected that Professional Staff will be specialists from Industry who will be paid according to a scale obtaining in the Secondary Sector. The centre will receive a State subsidy but will be run mainly on financial contributions from industrial establishments (cf. Report of Dr. Tran Luu Cung on a UNESCO/BIRD project).
- It is planned to build a University Institute for Technology which will serve the growing needs of the country in technical manpower. The National Institute of Education is helping in the preparatory research work.

### *The People's Republic of CONGO*

« L'Ecole du Peuple » aims at achieving 100% enrolment figures and works in partnership with national youth associations for the education and training of the citizen. Very recently, the Congolese Labour Party has introduced radical measures to consolidate the Revolution. Pupils are now called pioneers and grouped in brigades. A number of Brigades make up a *detachment* (new name for the class). The school becomes the Section. The aim is to foster a spirit of comradeship and to replace competition by cooperation. Instead of everyone for himself, what is favoured is « everyone for all, and all for everyone ».

The UNESCO « Regional Office for Education in Africa » (BREDA) participated in a two-week national training course in Educational Planning and Administration held in Brazzaville in December 1975 for the benefit of about 90 education specialists including inspectors, planners and teachers. The course has been highly successful and has triggered follow-up requests from the Congolese Government. The educational reform envisaged by the Country aims at a renewal of both content and method and the establishment of community spirit aimed at national development.

### *Central African Republic*

« L'Ecole de Promotion Collective » aims at giving some professional training to the young student so that he may contribute to the social and economic development of the country. The teacher is part of a team which includes farmers, craftsmen, village chief, etc. He makes contact with parents and tries to become integrated in the community. At present six such schools exist and ten more were due to be opened in October 1975.

### *Ivory Coast*

The Educational Television Project which became operational in 1971 aims at providing school education for as many people as can

be reached (100% by 1990 or 2000) introducing a new type education and providing out-of-school information education. The aim of the educational programmes is to stimulate students to play an active role in the learning situation. Evaluation is being carried out by an international team who publish documented results at regular intervals.

### *Senegal*

« L'Enseignement Moyen Pratique » proposes to tackle the problem of the primary school leaver who cannot be accommodated in the existing general and technical secondary schools by the creation of special centres, both rural and urban, where practical courses are held. The originality of the project lies in the fact that the courses are designed and run in complete agreement and cooperation with village leaders, farmers and rural workers. The Langomack centre has been operating for two years and gives training to the youth, both schooled and unschooled, of 12 adjoining villages. Five more centres have been planned for 1975-1976, two rural and three urban.

The project is a long-term one which expects to cover the whole territory in 10 years. In 1984 a total of 801 centres will have been built according to the long-term projection.

The reform of Education initiated in 1971 besides creating the new branch of Middle-level Practical Education (EMP) also laid stress on Middle-level Technical Education as opposed to General Education.

The distinction is clearly made by educational planners between technical education and vocational training. The former is not terminal but leads in fact to another cycle of education. For instance the junior technical colleges (Collège d'enseignement moyen technique) are considered as giving pre-training towards higher technical education. Vocational training by its very nature is geared to a profession and leads on directly to the employment world.

It is expected according to the IVth national Development Plan that an important building programme will be sponsored including the construction of 11 science blocks, 2 new junior colleges of general education and 9 new junior colleges of technical education to set up the infrastructure required for the implementation of the reform.

### *The Gambia*

A small territory with an area of about 10,000 sq Km surrounding the river Gambia, one of the finest waterways in West Africa, the Gambia has an education system patterned on the British system. However, pressures for changes are building up and the Ten Year Education Policy Document published by the Ministry of Education proposes the revision of the school curriculum at primary and secondary levels and at teacher training level to suit the economic, social and cultural needs of the country.

The government Five year National Development Plan attempts just that, at least in the field of secondary education. Out of every 5 children qualifying for secondary education, 4 enter junior secondary schools where they follow a 4-year course containing practical subjects such as home economics, metal work and wood work. However, the teaching is rendered rather ineffective owing to the shortage of raw materials often experienced in many schools (wood and metal) and the lack of suitable equipment.

In the new educational system, the junior secondary schools have been renamed secondary technical schools and their curriculum revised to include commercial, secretarial, scientific and technical subjects. It is foreseen that 70% of the pupils leaving these technical schools will either be sent to the training college to become junior school teachers or to vocational schools to become technicians. Existing mixed farming centres will be upgraded to rural development centres. Rural training centres will serve the dual purpose of training and production.

To implement and support these changes in the school curriculum, a *Curriculum Development Centre* is being created. This is a major step forward since it introduces an organizational structure and machinery for introducing and monitoring educational changes in the system. Such a centre must either be a separate unit with direct responsibility to the Ministry of Education or it must be a Division of Ministerial Headquarters. Its responsibilities lie with the task of developing curriculum for the nation's educational institutions.

Effective curriculum development must proceed systematically. The process may be analysed into 4 stages involving the following :

- 1) Determination of the specifications for the curriculum.  
(Content and objectives of the curriculum)
- 2) Development of learning material and instructional procedures.
- 3) Evaluation of the effectiveness of learning materials and instructional procedures.
- 4) The In-service and Pre-service training of teachers for curricular changes.

The proposed Gambian CDC includes a curriculum committee to which various subject curriculum panels report. These subject panels have the task of developing particular areas of the curriculum. In order to support the organizational structure, a number of units have been formed. Among these, we note the following :

- Languages Unit
- Science and Mathematics Unit
- Social Sciences Unit
- Commercial and Technical Education Unit
- Research and Evaluation Unit.

### *Ghana*

Curriculum development and planning has a longer history in Ghana where the « Curriculum Research and Development Division »

(CRDD) of the Ghana Teaching Service was established in September 1976. The work of the Division is carried out through the activities of 10 sections concerned respectively with Book Production, Schools Broadcast, Audio-Visual Aids, Home Science, Guidance and Counselling, Measurement and Evaluation, Mathematics, Environmental Studies and Language.

The professional staff number forty but in addition to the staff at Headquarters there are subject organisers who, though not responsible to the Director of the CRDD, are always available to perform extension services of the Division at both the regional and district levels. They are thus in direct contact with the classroom teacher.

An examination of the current projects and training programmes undertaken by the ten sections of the CRDD is revealing of the scope and depth of the work. Analysis, review and revision of the curriculum lead to innovations and experimentation in order to produce new curricula. New and appropriate resource materials are produced; projects and training programmes aimed at improving course content and effectiveness of instruction are set up; adhoc research into problems and practices are conducted. In fact the work illustrates in a striking way the kind of effective horizontal professional cooperation mentioned earlier, which can be so productive in supplying data, evidence and well-supported advice for the formulation of policy.

The cooperation with other institutions is quite extensive. Thus the CRDD has established a working relationship with other bodies both local and international; e.g. the Ghana Subject Associations, and the British Council. It also participates fully in the activities of the Science Education Programme for Africa (SEPA) and the West African Regional Mathematics Programme (WARMP).

Since 1973, the Government has set up a National Advisory Committee on Curriculum (NACC) for pre-university education. This committee will advise the Commissioner for Education on the content of education at all levels of pre-university education. In order to carry out its functions, the committee has set up subject panels and it is clear that the committee will find its work considerably simplified by the volume of data and experience already accumulated by the CRDD.

The importance and relevance of technical education to national development is borne out in a striking way by the case of the University of Science and Technology at Kumasi where recently a new centre called the Technology Consultancy Centre (TCC) has been created. Upon request from the government, the centre has already successfully undertaken various tasks for national importance. One such task was the repairing of the air-conditioning plant at the Korlo Bu Hospital in Accra. Another assignment concerned the local bus fleet which had become unserviceable through the lack of a spare part.

The TCC aims at using local expertise and developing indigenous skills and natural abilities. It favours the use of locally available raw materials and attempts to revitalize local techniques fallen into



disuse through the advent of the multinationals. Soap-making is one example of this. The centre thus serves the useful purpose of relating « academic » work to the practical needs of the country.

### *Sierra Leone*

The recent history of education in that country illustrates the importance for educational development of a national strategy worked out by competent administrative and educational planners.

In Sierra Leone, the happy conjuncture has occurred of a National Development Plan (1975-1979) which includes an extensive chapter on education, with a University-sponsored Education Review aiming at defining a long-term pattern of educational development.

Both documents give support to some general goals which include :

- (i) More rapid expansion and improvement in quality of Primary School Education and related Teacher Education.
- (ii) Deceleration of secondary and university enrolment growth in order to achieve greater alignment of secondary and post-secondary programmes with employment needs.

With respect to the first point, an analysis of the primary School situation in the country has identified a number of problem areas. They concern the high drop-out rate, the lack of correlation between traditional forms of education and the formal school system in existence, and the need for basic education for a greater proportion of the population.

Among the solutions proposed, one may mention primary School curriculum revision including use of local language and the establishment of community education centres for the promotion of out-of-school education and community development. The Bunumbu Teachers' College Project which was started in 1974 is an important step in the implementation of primary school reform. The Project aims at producing Primary School Teachers for rural schools and also community teachers.

At the secondary level, diversification programmes are sought in order to meet the demands of the diversified labour market. It cannot be said that the attempts have been very successful up to now but the secondary system is moving towards the concept of a diversified common core curriculum for the first 3 years followed by a variety of alternative specialized programmes which could incorporate applied subjects adapted to employment needs.

The Education Review Final Report advocates that technical and vocational education should be part of a closely coordinated system in which community education centres, diversified secondary schools, specialized vocational schools and diversified sixth form centres would play related and complementary roles. If implemented, such a plan would constitute a major innovation which attempts to

keep opportunities open for students to move back and forth between the specialized technical institutions and the secondary schools.

The rôle envisaged by the review committee for the university falls under the 3 headings : teaching, research and service. It would make it into a major instrument for national development. Geared to the identified needs of the country, the university would contribute in a direct and meaningful way to the solution of basic problems not only through teaching and research but also through rendering advisory services.

Manpower requirements and supply projection tables for 1975 to 1979 show that the university output is able to meet roughly 75 % of high level manpower requirements. However the area of greatest shortage is undoubtedly that of technicians and middle-level manpower especially in the arts, natural and social sciences. There is a scarcity of effective training programmes of 2 to 3 years' duration. Such training programmes would be functional and related directly to employment rather than aimed at providing access to university further education as they tend to do presently.

## CONCLUSION

There is little doubt that cooperation between countries in Africa in the educational field and more specifically in science education can be beneficial to all countries concerned. Some of the problems are indeed similar but the approaches are different. So the solution must be diverse if only at least because of the different structures and habits of mind inherited from the various colonial pasts. Over and above some justifiably persisting attitudes, it is sensed that a new African spirit is abroad and needs to be reinforced. The field being so diverse is rich and ideas can be borrowed. Two bilingual countries, Mauritius and Cameroon, have the advantage of being able to tune in on a wider field of information and of possible solutions.