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# The Role of International Cooperation in Science Education in Nigeria
## - Past, Present and the Way Forward -

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***Abstract:***

*It is generally accepted that good science education is a necessary factor for the economic development of any nation. In realization of this, the Nigerian National Policy on Education has provisions for quality science education for the citizenry. Securing high quality science education in any country therefore, requires joint effort or cooperation. Since the political and economic crises in Nigeria, such international cooperation has greatly declined and may be part of the problems for the crises in science education in Nigeria. This paper presents the past and present situations in science teaching and cooperation in Nigeria. Innovations in Japanese science education such as non-science major's curriculum - option 1A, textbook and science teaching material production and international cooperation activities between universities, faculties and science researchers are proposed as the way forward for Nigeria in the 21st century.*

## INTRODUCTION

Nigeria is one of the largest countries in Africa. She is also the most diversified of all the African countries culturally. In addition to being the most populous, the country, potentially is one of the richest in Africa. There are large deposits of minerals such as tin, gold and calcium oxide. The oil deposit makes her the sixth oil producing country of the world. Despite these bountiful resources, Nigeria's economic performance has been startlingly poor. Nigeria today is one of the developing or poor countries of the world.

Underdevelopment arises because of lack of knowledge of the proper and profitable use of available resources to increase the wealth of the people. Presently, it is generally accepted that good science education is a necessary factor for the economic development of any nation. Nigeria has also come to realize the importance of education in general and science education in particular as basic conditions for economic and social development. To tap the great and abundant natural resources, there is need therefore for good and effective science education. Consequently, science education is a major part of Nigerian education at all levels. Since 1999, when Nigeria elected the new democratic leaders, the process of socio-economic restructuring and adjustment has been the focus. There is the need therefore to plan for the future through effective science education reform. This also requires knowledge and cooperation from other countries especially the developed world.

International cooperation in education (science education) is an important mode of relationship between Nations. Cooperation in science education in Nigeria has a long history. This paper

traces the historical background of such cooperation in the past. It also discusses the present situation. Based on the past and the present, the paper discusses what, in the view of the writer should be the role of international cooperation in science education in Nigeria for the future.

## BACKGROUND OF SCIENCE EDUCATION IN NIGERIA

Education in general and science education in particular in Nigeria, for many years was more of a private enterprise. Today, it is greatly the opposite. There is government active participation in the provision of education for Nigerians. There are three major levels of education in Nigeria. These are the Primary, Secondary and Tertiary levels.

### National Policy on Science Education

The National Policy on Education Revised Edition (FME, 1981) states quite clearly the new structure of 6-3-3-4 system of education. Science as a subject is offered at the primary, secondary and tertiary levels of education in Nigeria.

The primary level of education is for children of ages 6 to 12 and is for the duration of 6 years. One of the general objectives of primary education as stated in the National Policy on Education (NPE), 1981 is "the laying of a sound basis for scientific and reflective thinking". To make it easier to carry out these activities, government planned to provide available materials and manpower for the teaching of science in primary schools. Government also planned to ensure that teaching method used for science at this level de-emphasize the memorization and regurgitation of facts. Methods that encourage practical, exploratory and experimental techniques were to be encouraged. In particular emphasis was on the development of scientific skills.

The secondary level is for children of ages 12 to 18. Secondary education in Nigeria is of two tiers. There is the three-years Junior Secondary School (JSS) for 12 to 14 aged students and three-years Senior Secondary Schooling (SSS) for 15 to 18. The introduction of science into secondary institutions, in Nigeria, dates back to 1878. Education at this level is expected to equip the students to live effectively in our modern age of science and technology. Consequently, at the Junior Secondary Schools, science, practical agriculture and pre-vocational subjects (such as metal work, electronics and mechanics) are part of the curriculum. Science at the Junior Secondary level, which was first taught as General Science, is now known as Integrated Science. The Federal Ministry of Education (1981) operationally defines Integrated Science as "that science course which is presented in such a way that pupils:

(a) Gain the concept of the fundamental unity of science

(b) Gain the commonality of approach to problems of scientific nature; and

(c) Are helped to gain an understanding of the role and function of science in everyday life and the world in which they live.ㅌ

Specially, integrated science objectives are to observe and explore the environment; develop basic process skills; develop functional knowledge of scientific concepts and principles;

explain simple natural phenomena; develop scientific attitudes and values such as curiosity, perseverance, critical reflection, objectivity, etc. and apply skills and knowledge gained in solving problems of everyday life in the environment and relate the experiences in each subject area to other areas.

At the senior secondary, the three basic core science subjects are biology, chemistry and physics. At this level a student may be studying biology, physics and chemistry concurrently. This has been challenged by curriculum development as it emphasizes the treating of all secondary school students as future scientists (Bajah, 1999). It is being argued that students be allowed to study alternative science courses.

Science is also an important subject at tertiary Institutions in Nigeria. Such institutions include Universities, Polytechnics, Colleges of Technology and Colleges of Education. Several courses in science and technology exist in these institutions. There are faculties of Agriculture, Engineering and Science, as well as School of Medicine in almost all Nigerian Universities. The National Policy on Education stipulates that a greater proportion of education expenditure will be devoted to Science and Technology at this level.

Effective implementation of the national policy on science education requires adequate and qualified science teachers, translation of the policy into workable curriculum and good science textbooks. To what extent has these been achieved in Nigeria?

## Nigerian Science Teachers

The importance of teachers in the implementation of science education programs is acknowledged all over the world. In Nigeria, science teachers are categorized based on the level at which they teach and the qualification obtained. As a result there are elementary, secondary and tertiary level science teachers. There are also Non-graduate and graduate teachers in addition to classifying teachers based on the specific subjects like chemistry, biology, physics or integrated science teachers. One other category of science teachers in Nigeria is the Science Educators. These are Science Teacher-Trainers. These teachers often teach science pedagogy and not the science content even thought they have content knowledge in the different sciences. In the past, Primary Science Teachers held the Teacher Grade Two Certificate (TC II). This certificate, which was awarded at the teachers' college, is being faced out since the minimum qualification for the teaching profession now is the National Certificate in Education (NCE), obtained after a three year program at a College of Education (formerly Advanced Teachers' College) or Polytechnic. There are three major categories of NCE Science teachers. There are those who majored in a combination of two single science subjects (e.g. Chemistry - Biology, or Chemistry - Physics), Integrated Science (single major), i.e. offered one single science subject and a science course known as integrated science and Integrated Science (double Major), i.e. did not offer any of physics, biology or chemistry but an interwoven course content of the three science subjects.

Most science teachers at the secondary schools are graduates of universities or polytechnics. There are two types of such graduate science teachers. The first group consists of those who offered science content as well as education or pedagogic content for science teaching. This

group is further sub divided into two. Those with higher credit load in the science content and those with higher credit load in pedagogic (education) content. The first subgroup is awarded a Bachelor of Science - Education {B. Sc. (Ed.)} degree, while the second is awarded the Bachelor of Education - Science {B. Ed. (Sc)}. The second group of science teachers is those who read pure sciences. These teachers hold a Bachelor of Science in their different subject areas of specialization. However, these teachers are expected to obtain a teaching qualification through in- service course known as Post Graduate Diploma in Education (PGDE). This is quite different from the situation in many other countries where a teaching qualification is necessary before an employment to teach is sought.

At the Higher Institutions such as Universities, Polytechnics and Colleges of Education, science teachers vary depending on their teaching areas of specialization. Often these teachers do not have professional teaching background. Those with such professional background are found in the faculty or Institute of Education and are referred to as Science Educators.

Training of Science Teachers in Nigerian Universities is basically a pre-service program. Programs are for 4 years. However NCE Science Student-teachers may spend two or three years for the award of the degrees. This depends on the grade at the NCE level. Science teachers who wish to up grade and who had Distinctions in their major subjects at the College of Education are admitted to a 2-year program for the Bachelor degree. Those with less than distinction are offered a three-year program. However there are in-service program for practicing teachers. These are programs run during the long vacation when teachers at the primary and secondary schools are on holidays. This is also called B. Ed. Part-time on sandwich program. This program has been under serious attach in recent years as many feel the program does not allow for meaningful learning and teaching within the available time.

## The Science Curriculum

Science in Nigerian Colleges of Education in the past was in the form of biology, chemistry and physics. Today it is fast becoming Integrated Science. Integrated Science program was translated into practice in Nigerian Colleges of Education only in 1990/91 sessions. The curriculum provides for double and single majors. In the double major program the student-teacher studies science mainly as integrated science. Students for this program are not expected to offer any of the single science courses, namely- biology, chemistry, and physics. The program is a 72-course credit load spread over a three-year duration. The single-major program requires a student to offer integrated science course in addition to one other single science subject. This program is a 40-course credit load in integrated science, with the remaining load from any of the single science subjects and is also spread over a period of three years. Today integrated science is offered in all colleges of Education in Nigeria. The program has helped produce the needed manpower for integrated science teaching at the primary and Junior Secondary levels of education. However, reports are that the program has not been quite successful (Olarewaju, 1987; Omoifo, 1996; 1995).

With the development of integrated science at the NCE level, it became necessary to make provision for further education of the recipients. For this reason the National University Commission

(NUC) directed the introduction of integrated courses in the Nigeria Universities. Integrated science today is offered in almost all Nigerian universities. In some universities it is offered as a mandatory elective for science major under-graduates. In such universities it is either a one semester or one session course. In others it is a full-fledged course. It is offered as a major program and a B. Ed. or B.Sc. (Ed.) certificate awarded to the recipients. Some universities are making serious plans to offer masters program in integrated science. In fact there are over ten degree awarding institutions in integrated science in Nigeria.

To effectively teach and study science at any level in Nigeria requires adequate resources, which includes laboratories and textbooks. Based on the new structure of education in Nigeria, the Federal Ministry of Education set about developing what it described as Core Curriculum and to date, it has successfully guided the production Core Curriculum for Primary Science (Published in November 1980). Like the Primary Science, Core Curriculum for Integrated Science: Junior Secondary School (Published in July 1981) is available for use by schools. The Core Curriculum for Integrated Science attempts at presenting topics, performance objectives, content and activities in a structured teaching manner. In a way, the Core Curriculum is some form of teaching guide. The content of the core curriculum for junior secondary is structured under six major themes:

* Theme 1: You as a living thing.
* Theme 2: You and your home.
* Theme 3: Living components of the environment.
* Theme 4: Non-Living components of the environment.
* Theme 5: Saving your energy.
* Theme 6: Controlling the environment.

Associations such as the Science Teachers' Association of Nigeria (STAN) or individuals, author Science books in Nigeria. Authors are expected to write from the national core curriculum. Different schools within the same local government or state adopt different books. Style of book writing differs from one author to the other. STAN is a major publisher of science text books in Nigeria. There is no dearth of good science textbooks being written and published in Nigeria (Bajah, 1999).

## Science laboratories

Science laboratories as places where students do science are an important teaching and learning resource. Laboratory, which may be part of the classroom or separate special room do not exist in many primary schools in Nigeria. Government's plan to de-emphasis regurgitating of scientific facts can never be achieved without science laboratories. Even at the secondary level, science laboratories are poorly equipped. At Universities, surveys have shown deterioration of laboratories. Laboratories built to accommodate certain number of students now accommodate twice as much due to high demand for schooling in recent time (Omoifo et al, 2001). Japan has excelled in the area of textbooks and laboratory. Ideas from Japan will greatly improve the situation of science teaching in Nigeria.

# INTERNATIONAL COOPERATION IN SCIENCE EDUCATION IN NIGERIA

## Establishment of Science Courses in Government Departments and Higher Institutions

Science teaching in Nigerian started with missionary activities. The period 1842 to 1882 often referred to as Era of Exclusive Christian Missionary Education in Southern Nigeria included only the teaching of agriculture in schools. In 1895, mechanics was introduced (as vocational course) in Hope Waddell Institute, founded in Calabar by the Church of Scotland Mission. It was purely a practical course and so little of theories and principles were in the curriculum. The first course in Electricity and Magnetism was introduced in 1931 at a junior technical staff-training course, Lagos. In 1942, an Apprentice Course in Mechanical Engineering was introduced in Kaduna. This course lasted for 5 years and 6 to 8 students were admitted. A forestry school was opened at Samaru Zaria in present Kaduna State in 1938, while a veterinary school in Vom near Jos, Plateau State, opened in 1935. These were not school science but departmental training, and marked the beginning of organized technical and vocational science education in cooperation with the British Government (Fafunwa, 1974). In 1932, engineering course started at Yaba Higher College, Lagos. Thus there were no formally organized science courses at the primary and secondary levels of education at this period.

Colleges of Arts, Sciences and Technology were established in 1952 at Enugu, Ibadan and Zaria, representing the east, the west and the north respectively. This was through the work of committee of two - F. J. Harlow, Principal of Chelsea Polytechnic London and W. H. Thorp, Nigerian Deputy-Director of Education -Technical (Fafunwa, 1974). Courses in civil engineering and sub-professional engineering, mining, and science were introduced. To ensure international acceptability the colleges entered into a relationship with London University in collaboration with the University College Ibadan, in running a degree program in engineering. These colleges were taken over by three of the first generation universities in Nigeria. Ahmadu Bello University, Zaria, took over that in Zaria, University of Nigeria Nsukka, that at Enugu and Ife (now Obafemi Awolowo) University, Ile-Ife took over that at Ibadan. Pharmacy was also introduced. Science education in Nigeria therefore started from higher institutions and passed down to the elementary level. This is in contrary with the situation in many countries where science started from the lower levels and then moved up to higher institutions.

## Post Independence Cooperation

Nigeria gained independence in 1960. The launching of Sputnik by Russians in the late 1950s sparked off the world's science curriculum reform. Nigeria was not left out. Cooperation in Science Education after Independence was mainly in the areas of science curriculum reform. In 1963 a group of science educators and scientists launched elementary science programs for primary schools. Improvisation of science teaching and learning materials from local resources was emphasized.

In 1968, the then Mid-West later Bendel but now Edo and Delta States of Nigeria established ゞScience is Discoveryヒ, an innovative elementary science curriculum for elementary schools. This was in cooperation with UNESCO and UNICEF and called Mid-West State Primary Science Project

(MPSP). The project mainly trained primary science teachers and developed primary science curriculum. The project after 6 years in 100 pilot schools was implemented on a state-wise basis. Longmans (Nigeria) limited published the series of textbooks for the project. This project was aimed at developing in primary school science pupils the attitude of enquiry. The project did not stand the test of time as it has long been faced out.

The Aiyetoro Basic Science Program, which dates back to the early 60s and was supported jointly by the Ford Foundation through Comparative Education Study and Adaptation Center (CESAC) and the then Western Regional Government was another of such cooperation. The Aiyetoro program had been properly conceived and emphasized the teaching of science in native language or mother tongue. Since the program was being introduced in the West the use of Yoruba language formed part of the innovation. Very useful training workshops for science educators were organized; materials were developed and tried out in pilot schools in the country and more coincidentally, the program covered the first two years of the secondary school science work. From all angles, the Aiyetoro Basic Science Program had very great potential. However it did not also stand the test of time and have since been faced out. This is in contrary to science education in mother tongue or native language, which is flourishing in a country like Japan. Nigeria no doubt has a lot to learn from Japan in this respect.

Ford Foundation through the Comparative Education Study and Adaptation Center (CESAC) financed the revision of science syllabuses in the late 60s and early 70s. Additional support was also received from the Curriculum Renewal and Educational Development Overseas (CREDO) through the British Council in Nigeria. Support in the form of curriculum materials was received from the United Nations Educational, Scientific and Cultural Organization (UNESCO) and from a publishing company, Longmans Nigeria Limited. All these financial and material support coupled with good will from various educational establishments set the curriculum committees working. Curriculum Development Newsletter No. 1, which contained statement of philosophy, methodology, content and evaluation of integrated science was published in 1970.

Integrated science in Nigeria has revolutionalized science in junior secondary schools. Heinemann Educational Books International, which published the Scottish Integrated Science popularly known as Science for the 70's also produced in Scotland, was to collaborate with the Nigerian branch of the company. The writing workshops were organized and the books were produced as the STAN Nigeria Integrated Science Project (NISP) texts in 1971 in two volumes - Books One and Two. Each volume consisted of a pupils' text, a teachers' guide and a pupils' workbook. The publication of two integrated science textbooks and the apparent success of the books in Nigerian schools encouraged other publishers to try their hands at integrated science. So far two other publishing houses have produced their own versions of integrated science texts; these are by: Macmillan Publishers Nig. Ltd in 1973 and Longman Nigerian Ltd in 1976. Again these new sets of books followed closely the guidelines in the STAN Curriculum Newsletter No. 1 and like the other; the books consisted of the pupils' text, teachers' guide and pupils' workbook.

For proper implementation of any science program adequate teaching and learning materials are needed. Most importantly is the development of textual materials such as teachers' guide and students' texts. The British government assisted the Nigerian Government set up the Nigerian Integrated Science Teacher Education Project (NISTEP) with headquarters at the Institute of

Education, Ahmadu Bello University Zaria. The project aimed at developing materials for the double major integrated science course at NCE level as approved by the National Commission for Colleges of Education (NCCE). Workshops were organized for material writing. Resource persons developed trial drafts for the various integrated science courses for years 1, 2 and 3. Dr. C.G. Butchard, NISTEP adviser, edited the draft materials. In addition seminars and conferences were organized for teacher-trainers or users of the developed materials. Recently, coordinating units were set up at the Colleges of Education Abeokuta, and Alvan Ikoku College of Education Owerri. These are to coordinate NISTEP activities in the West and East respectively. The texts developed for the various courses emphasize the content, activities and necessary apparatus and materials for the activities. There are, also, teaching notes and exercises. Through the activities of NISTEP many science teachers and educators have had opportunity for either six or twelve months course at Kings College, London on integrated science. British government has withdrawn from the cooperation and the program is almost dead.

Nigeria in the 1987 was known to assist other African countries with technical aides. Under this cooperation young Nigerian medical doctors, engineers, science teachers and others were sent to several different African countries. Nigeria's role as a nation among nations is thus well acknowledged. Nigerian Universities also accumulated a considerable experience in inter-university cooperation in the past. Such linkages in the past helped develop many faculties to high-level positions in the field of academics. For example, in the late 1970s the Nigerian University Commission organized staff and linkage scouting missions to several parts of the world (Aminu, 1986). One team toured the United Kingdom, Scandinavia, West Germany and Eastern Europe. Another toured the United States of America. A third visited the Middle and Far East. At this time there were Nigerian Universities' offices in many key centers round the world. The center in London covered the United Kingdom and Europe; Ottawa for Canada; Washington D.C. for the United States and Cairo for the Middle and Far East. These centers explored and serviced inter-institutional links and any other technical cooperation agreements. These offices were evidences of Nigerian deep belief in international cooperation in (higher) education in general and in science education in particular. Unfortunately political and organizational problems have affected international cooperation between Nigerian Universities and Universities in developed worlds such as Japan. Nigeria was under military rule for over 75% of her years of independence. This was found not comfortable for exchange of staff and students in education (Aminu, 1986).

Nigeria has also enjoyed international cooperation with donor bodies and organizations for many decades now. The organizations provided personnel (trained or supplied) for the implementation of programs under cooperation. Such organizations include British Council, United States Peace Corps, Canadian University Service Overseas (CUSO), British Voluntary Service Organization, Swedish International Development Agency (SIDA), Canadian International Development Agency (CIDA), Norwegian Agency for Development (NORAD), Danish International Development Agency (DANIDA), the International Development Association (IDA), United States Agency for International Development (USAID), the European Economic Community (EEC), the British Overseas Development Ministry (ODM), the Ford and Rockefeller Foundations, the African Curriculum Organization (ACO) and the African Bureau for Educational Sciences (Yoloye and Bajah,

1981). Science programs such as Integrated Science, Mid-West (Formerly Bendel and now Edo and Delta States in Nigeria ✗Science is Discovery₹ were sponsored by organizations such as UNESCO. Ford Foundation sponsored experimental projects for science curriculum development and production of science equipment. These Collaborations, institutional linkages and cooperation with Nigeria in the twentieth century can be described as quite high. However, educational system in the country is greatly experiencing problems. The failures may be attributed to the dependent rather than interdependent collaborations that existed for the programs.

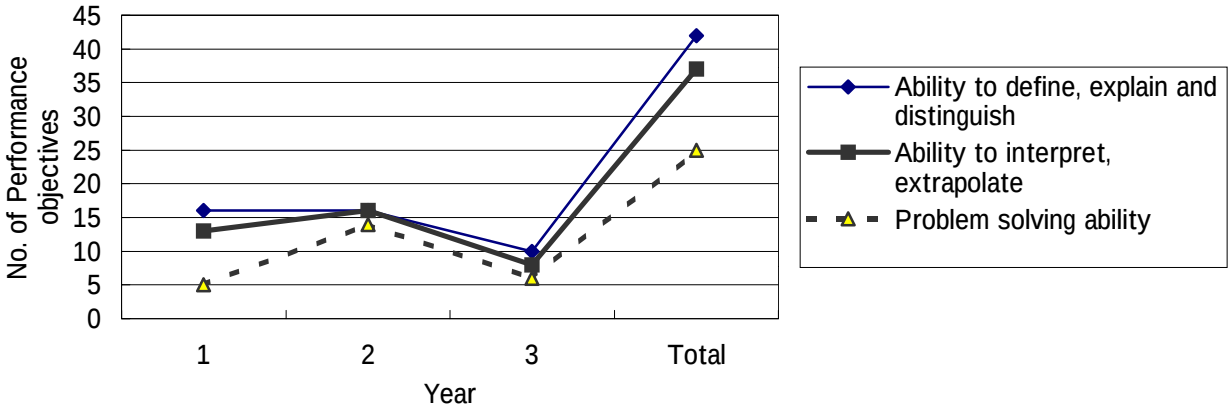
## EVIDENCE OF CRISIS IN NIGERIAN SCIENCE EDUCATION

Nigeria is the only African country with as many as more than 40 Universities, about 44 polytechnics, over 56 Colleges of Education, so many secondary and primary schools as is found in many developed countries such as Japan, Germany and the United States. That Science Education program in Nigeria is in crises is not questionable. Resources both human and infrastructure are on the decay. Results from survey of graduates of Nigerian Universities (Omoifo, C. N. et al. 2001) testify to this. High orientation towards social sciences and humanity is the choice among students in Nigeria. Fields such as science, engineering, agriculture and health seems to be given low priority. Unfortunately they are the fields that are of great need if Nigeria is to be scientifically and technologically developed.

In 1999, the annual conference of the Science Teachers Association of Nigeria focused on the evaluation of science technology and mathematics education in Nigeria. Presentations revealed the present situation of science teaching in Nigeria. Problems and constraints to science teaching as well as areas of achievements were reported. A summary of reports highlights the constraints of policy implementation, assessment procedures, the importance of resource materials and a host of others.

Lack of adequate and relevant science teaching and learning equipments has resulted in science being learnt more as a body of knowledge. This results in students emphasizing recall of scientific information. Problem solving ability, which is crucial for scientific achievement, is low. This problem is further shown in the content analysis of science performance objectives (Owolabi, 1999) as shown on fig. 1.

Fig. 1: Content Analysis of Senior Secondary School Physics Curriculum




Statistics also show that students are not performing well in science examinations. Ogunleye (1999) reported students' performance in the Physics Senior Secondary School Certificate Examination (SSCE) as shown in table 1:

**Table 1: Physics Science Students' Performance at the SSCE (1990 – 1997)**

| Year | Total Number of Students | % Pass | % fail |
|---|---|---|---|
| 1990 | 63,161 | 52.35 | 47.65 |
| 1991 | 96,742 | 47.17 | 52.83 |
| 1992 | 122,809 | 46.49 | 53.51 |
| 1993 | 152,275 | 50.93 | 49.10 |
| 1994 | 146,000 | 42.40 | 57.6 |
| 1995 | 120,768 | 53.30 | 46.7 |
| 1996 | 132,768 | 43.20 | 56.8 |
| 1997 | 127,486 | 44.1 | 55.9 |

***Source: Ogunleye, 1999 STAN Proceeding***

In addition, available learning resources for teaching and learning primary science and the percentage of teachers competent to use such resources, in schools is low (Nwoji 1999), as summarized in table 2.

**Table 2: Learning and Teaching Resources for Primary Science in Enugu South Local Government of Nigeria.**

| Items | Availability of Resources (%) | Percentage of Teachers Competent to Use Resources |
|---|---|---|
| Charts | 80 | 100 |
| Pictures | 70 | 100 |
| Models | 10 | 100 |
| Posters | 20 | 100 |
| Real Objects | 50 | 100 |
| Specimens | 30 | 100 |
| Science Learning Kits | 10 | 0 |

| | | |
|---|---|---|
| Scalpel (knife) | 20 | 70 |
| Dissecting pan | 0 | 0 |
| Candle | 10 | 100 |
| Jars | 50 | 100 |
| Matches | 60 | 100 |
| Watches/Clock | 20 | 100 |
| Chemicals | 10 | 0 |
| Beakers/Cylinders | 0 | 0 |
| Video/Taped Instructions | 0 | 85 |
| Radio | 0 | 80 |
| Television | 0 | 80 |
| Stove | 10 | 100 |
| Burners | 0 | 10 |
| Computer | 0 | 0 |
| First Aid Box | 20 | 100 |

***Source: Nwoji, 1999 STAN Proceeding***

## ROLE OF INTERNATIONAL COOPERATION FOR THE FUTURE

It is not easy to secure high quality science education in any country without a joint effort from other countries. To arrest the decline in the effectiveness of science education in Nigeria, there is need for a new trend in international cooperation as the way forward. Perhaps what are needed are not just funds from donor organizations and government but joint projects at different levels.

Japan is playing a very vital role in such international cooperation at present. Japanese policy on international cooperation in education includes teaching, research, textbooks, library and technical services, bilateral programs, exchange of students, teachers and educational leaders, researchers, cooperative Study activities, development assistance, opportunities for sabbatical leave, research projects, post graduate training etc. These are also important areas of cooperation with Nigeria

Globalization in the past decades has made it possible for humans to be inter-connected more than ever before. Equally, many nations have become more and more interdependent. The number of international representative in the form of foreign students, teachers and researchers at all levels of education testify to this dwindling situation in international cooperation in Nigerian education in general and science education in particular. The percentage of foreign students at Hiroshima and Benin Universities are such indicators of international cooperation. Of very important are the joint projects between many universities with universities in the Japan. Although these are highly North-North (N-N) linkages, Japan has high cooperative activities with South Africa and East Africa in Science Education. Ghana from West Africa is becoming integrated into Japanese international cooperative activities. These are examples of North-South (N-S) linkages. Nigeria would also welcome such cooperation to a higher degree now. Indicators of International Cooperation in Science Education within Benin and Hiroshima Universities show the great necessity for a renewed form of international cooperation in Nigeria. Such university cooperation is very necessary for this is where science teachers for the lower levels are produced. Hiroshima University had 60 foreign undergraduate and 536 foreign graduate students in the 1998/99 sessions, and 57 and 685 foreign undergraduates and graduates respectively in the 2000/2001 sessions (Hiroshima University, 1999; 2001). Although a slight

decrease for the foreign undergraduates, in general it shows increase in the number of foreign students in the university from 596 in 1998/99 to 742 in the 2000/01 sessions. For the University of Benin, the total number foreign students for 1988/89 sessions were 93. In 1993/94 sessions there were 73 foreign students and to 68 in 1995/96 sessions (University of Benin, 1995; 1998). Unlike the situation in Hiroshima University this is a decline in the number of foreign students, an indication of decline also in international cooperation. By the year 2001, Hiroshima University has international Exchange programs and joint research projects with 37 universities and polytechnics in 17 countries at the university level of agreement, and 60 such agreements at faculties, departments, schools and institutes' level (Hiroshima University, 2001). The situation in University of Benin is in no way similar. International representations in Nigerian University councils existed in the past. In the University of Benin council, there were representatives from British and American Universities. In 1971/72 sessions, the University of Benin had 4 of her 20 council members as foreigners. Two represented foreign universities while the other 2 represented the two major oil companies gulf and shell in the country. Similarly, in 1973 and 1974, the foreign representatives increased to 6. 4 represented foreign universities while 2 represented the two oil companies in 1973 and 2 for foreign universities and 4 for the two oil companies in 1974. These representations enabled cooperation between the universities. From 1975, the situation began to change. There was only one representative who was a foreigner in the 22 council members. Today foreign representatives and joint research projects at university and lower levels is almost non-existent. There is need to reverse this trend for the future especially in science education in these days of multi-cultural science education (Ogawa, 1996; 1995; Jegede, 1995).

Nigerian National Policy stipulates that government will after consultation with the states set up a National Committee to advise on the production of suitable textbooks and instructional materials for the whole Federation. This is yet to be achieved after several decades. Japan has excelled in this regard. Textbook production in Japan provides for effective teacher and students' guide. Students' activities and assessment activities are well cared for. The process of textbook production for Japanese education system gives room for the control of quality texts for science. Unnecessary competition between publishers and ｸhungryｷ authors is highly reduced. This is very essential for science education in Nigeria. From this writer' personal science classroom observations, it is most interesting and requires mentioning that these materials have greatly helped science teachers in Japanese Elementary Schools, who are not necessarily science specialists, to teach science and carry out effective science activities in schools. No wonder the high performance of Japanese students in International Mathematics and Science Evaluations such as in the Third International Mathematics and Science Study (TIMSS). Cooperation with Japan will led to establishment of such project in Nigeria. This is a needed cooperation at the national level.

Another vital area of cooperation between Japan and Nigeria is in the area of science curriculum reform. Although Nigeria is famous with the integrated science at the primary and junior secondary levels, problems still exist at the senior school level. Science curriculum at the senior secondary schools, which treats all students as future scientists, is being challenged (Bajah, 1999). It is being argued that students be allowed to study alternative science courses.

Japan's model of non-science major's curriculum - option 1A (Shimozawa, 1989) is a welcome idea for Nigeria. This will further strengthen the aim of Nigerian Integrated Science and help in the recent trend of Science for All.

## CONCLUSION

Nigeria has not achieved her major goals in science and technology. High quality science education in any nation requires cooperation with others. Linkages and cooperation are therefore very necessary for the continuous development of Nigeria's Science Education program. Nigeria is known to have large share of the world's reserve of natural resources. Unless fields such as science, engineering and agriculture are highly emphasized, it may not be possible for her to exploit, process and utilize these resources. These fields are of great importance if Nigerian Scientists and Technologists are to be trained and produced. One other problem facing Nigeria as a country today is over population and malnutrition. To be able to solve this problem, Nigeria needs to improve on her health care and food production. This also means attaining self-sufficiency in food production. Unfortunately, enrolment and graduation in health and agriculture in Nigerian Universities is not as encouraging. In Nigeria, the policy for admission into Nigerian universities is in the ratio 60:40, for science and non-science fields of study respectively. Unfortunately students are never available to meet this ratio for the sciences. Reasons such as the difficulty nature of studying science, availability of adequate qualified science teachers and so many other factors have been proffered. To achieve this more science students for universities need to be produced at the primary and secondary levels. Science should also be demystified and resources to make science teaching and learning made more interesting. To achieve all these require a new direction in international cooperation.

Statistics abound that the three largest industrial economies of the United States, Germany and Japan have been the largest bilateral donors to Nigeria. It is now time to extend the cooperation between Japan and Nigeria to include international joint projects especially at university and faculty or departmental levels. I present the University of Benin to the Hiroshima University for pilot study in such international joint university cooperation in science education in the 21st century. The then Japanese Prime Minister, Mr. Yoshiro Mori visit to Nigerian, January 12, 2001 should be a catalyst to further strengthen such international cooperation.

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