

# Science Education and the Challenges Facing Its Integration Into the 21st Century School System in a Globalized World: A Case of Igbo Nation

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This paper is a study of historical foundations of science education in Igboland, its nature and scope as well as the challenges facing its integration into the 21st century school system in a globalized world. The authors found that there were many scientific activities in Igbo culture, but many problems hinder their integration into the basic needs of modern society. For instance, imposing the needs of a globalized world of the 21st century on modernized African (Igbo) science is like imposing industrial chemistry on non-industrialized society. Implications of the findings were discussed in this paper.

*Keywords:* science education, globalization, Igboland, Igbo culture, Igbo metaphysics, Igbo science, indigenous Igbo ideologies, western education in Igbo land

## The Purpose of the Study

The purpose of this study is to identify scientific activities in pre-colonial Igbo society and show how these could be integrated into the school system. The paper also explored/examined the extent these indigenous science process skills can be harnessed to meet the challenges of globalization.

Specifically, the study shall be investigating the following:

- (1) History of education in pre-colonial Igbo society in order to dig up the root of Igbo science process skills;
- (2) The advent of western education among the Igbos and establishment of schools;
- (3) The scientific process skills in Igbo culture;
- (4) Globalization and science education;
- (5) Issues, implications, and challenges of globalization in Igbo nation;
- (6) Summary;
- (7) Recommendations.

## History of Education in Pre-colonial Igbo Society

Education in pre-colonial Igbo society was merely a process of enculturation through instructional agents.

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Indigenous people have culture. Colonial masters did not recognize this fact. It was believed that Africa, south of Sahara, and north of the River Limpopo (the heartland of Igbo nation), was one universal den of waste, misery, and desolation. They had no system of ethics and no principles of conduct (Otoni, 1964, p. 36). This Eurocentric version of history notwithstanding, there were systems of ethics and principles of conduct which formed the foundation of Igbo culture and civilization. Out of this matrix, Igbo traditional education developed its objectives which gave rise to indigenous Igbo ideologies, namely:

- (1) Communalism (Igbo socialism/extended family system);
- (2) Utilitarianism (functional education);
- (3) Conservatism (conservative socializing agencies/perennialism);
- (4) Pragmatism (role preparation/skill acquisition);
- (5) Totalitarianism (children learnt everything/i.e., holistic education).

### **Communalism**

This is Igbo socialism/extended family system (“Be your brother’s keeper”). To be your brother’s keeper is a basic norm in Igbo society. Extended family system is the authentic Igbo socialism not Russian socialism or Chinese type. Igbo socialism is opposed to capitalism (Ejiofor, 2000, pp. 100-105). Some refer to Igbo socialism as proto-socialism or proto-type of communism.

The purpose of capitalism is to create a happy society through exploitation, subjugation, and alienation. Capitalist’s attitude infiltrated into Igbo society through colonialism.

Collective responsibility is a manifestation of Igbo socialism. Education is for the good of the community. Riches and wealth are acquired for the good of all. Collective responsibility as opposed to the “rugged individualism” of the Whiteman was Igbo tradition. “Espirito de corps” was cherished. No man was self-sufficient. No man was an island. Every blood relation is a brother or sister. The idea of nephew or niece, half-brother or half-sister is strange. The idea of grandmother or grandfather is basic in Igbo culture. This is Igbo socialism, which needless to say is distributive, not acquisitive (Ejiofor, 2000, pp. 100-107). Wealth is acquired to give help to less privileged relatives. It is strange to amass wealth in order to build personal political or economic empire. Nobody wanted wealth in order to hand it over to others or gain political power. A rich man acquired wealth in order to serve his brothers and sisters. The man who used his wealth to intimidate, dominate, or subdue his relatives is despised. Education for the good of the community produced public-spirited citizens of transparency and honesty.

### **Utilitarianism**

Functional education or education for use not for ornamentation was upheld. There was no unemployment. Vocationalization gave Igbo education job orientation. Apprenticeship system was another term for Igbo education system.

### **Conservatism**

This is education for promotion of cultural heritage. Eternal values were conserved. The family and elders of the land were conservative socializing agencies. These were Igbo perennialists who viewed the unwritten (hidden) curriculum as a package consisting of permanent studies which included spiritual values, human values, and material values. They saw knowledge as fixed and permanent.

Induction into the society was by indoctrination. Desirable status quo was conserved. Ideological

conformity was achieved.

### **Pragmatism**

Role preparation through skill acquisition for successful adult life was a cultural universal in Igboland. Practical training for adult life was cherished. Children were trained for future roles. Boy-child trained as future father. Girl-child trained as future mother. Mother-craft was part of skill acquisition.

Ability to perform productive tasks was valued more than producing a bookful blockhead with loads of learned lumber in his head (described as a spurious inheritance of pure intellectualism).

### **Totalitarianism**

Children learnt everything. Some Igbos called it Pan-Sophism. Others felt it was Holisticism (Nebonta, 2009, pp. 43-50; Ochitti, 2007, pp. 59-61). It was education for all-round efficiency—moral, spiritual, physical, mental, economic, and political efficiency. No choice of subjects was allowed. However, elements of culture were not lacking, viz.:

(1) Cultural universals: Core values (marriage, language, festivals, and ceremonies) were retained;

(2) Cultural specialties: These were professions like carving and smithery. Religions groups, priests, and diviners specialize in fortune-telling. There were trading oligarchies. The Aros and Nri constitute the two hegemonies in Igboland—the Aro trading oligarchy and Nri ritual hegemony. Nri dominance and hegemony was founded on the control of Igbo calendar, ritual and agricultural cycle. Nri is the centre of Igbo culture and the cultural metropolis of Igboland. All Igbo culture came from Nri and Aro hegemony was based on long-distance trade—the slaving oligarchy (1807–1927), bolstered up by a widely recognized Aro oracle—Chukwu-Ibini-Ukpabi, and strong alliance with warlike neighbours with martial tradition, viz., Abam Ohafia and Edda. With these warmongers, the Aro maintained commercial oligarchy and dominance in the economic life of the Igbo and their neighbours. The blow-up and military overthrow of Chukwu-Ibini-Ukpabi in the Aro expedition of 1901–1902 brought Aro hegemony to an end, even though the Aro struggled hard to retain their hegemony long after the famous Aro expedition (up to 1927);

(3) Cultural alternatives: There were likes and dislikes, fashions and fads, choice of diet, and alternative ways of doing things.

The above five ideologies were rooted in three Igbo philosophies of life—metaphysics, epistemology, and axiology.

### **Igbo Metaphysics**

Belief in life after death, Igbos are very religious. Ancestor worship is basic in Igbo cosmological education. All the three aspect of metaphysics form part of the cosmological education, namely:

(1) Ontology: Belief in Supreme Being, God, the creator, or almighty god and pantheon of gods and goddesses or minor gods/deities. They believe in reincarnation, witches, and wizards;

(2) Cosmology: Origin of the universe richly found in Igbo mythical charter was preserved in Nri corpus of myths. Origin of Igbo market days and certain food crops constitute Igbo cosmology and worldview;

(3) Causality: Cause and effect relationship were amply elaborated. Nemesis, Karmic laws (retributive justice) was taught through oral literature—folktales, myths, and legends.

### **Epistemology**

Igbo oral tradition/oral literature was the main source of knowledge. Oral literature could be divided into

three:

- (1) Myths—concerned with superhuman elements—activities of gods and goddesses in human affairs;
- (2) Legends: concerned with human elements—activities of human heroes—cultural heroes and warlords;
- (3) Folktale/folklore: concerned with ballads, proverbs, riddles, and poems.

### **Axiology**

This is taught by presenting Igbo ethics, aesthetics, and political philosophy.

(1) Igbo ethics: Concerned with moral content of Igbo civilization. It is the Igbo moral philosophy—code of conduct and social norms. Three types of norms in Igbo culture:

- (a) Folkways—social convention;
- (b) Mores—taboos;
- (c) Law—legal codes, rules, and regulations;

(2) Aesthetics: Concerned with principles of beauty and ugliness. Lay emphasis on Igbo arts and crafts, rules of hygiene, use of cosmetics, cultural refinement, and general aesthetic awareness;

(3) Political philosophy—democratic gerontocracy.

The above is a basic outline on which Igbo pre-colonial education was made to revolve. It was on this outline that Igbo science was rooted.

### **Igbo Science**

Science is knowledge obtained by observation and testing of facts. It is empirical or sensory information about the behaviour of natural and physical world-based on facts and figures which can be proved by experiment. Igbo cosmological experience is filled with scientific knowledge as can be seen in the inventory of Igbo science processes.

The above was the state of the art before the introduction of western education in Igboland on July 26, 1857, by Samuel Adjai Crowther, Simon Jonas, and Christopher Taylor of the CMS (Church Missionary Society) Niger Mission.

## **The Advent of Western Education and Establishment of Schools**

Igboland is found on both banks of the River Niger between Lokoja in the north and Bonny-Opobo in the Niger Delta. Majority of Igbo people are living towards the east of the great River in Anambra, Imo, Abia, Enugu, Ebonyi, and parts of Rivers State. These are the people of eastern Igboland. Igbos inhabiting the western bank of the River Niger is called western Igbos or Ika Igbos. Cross River Igbos are the Aros and their neighbours. Among the Igbos of southeast Nigeria, western education came along with the Niger Mission of 1857.

Specifically, the Niger Mission was launched from three axis (Afigbo, 1981, p. 338): the River Niger Front, Bonny-Opobo axis, and the Cross River axis.

### **The River Niger Front**

The Niger Mission dated back to July 26, 1857 when Dr. Baike, Bishop Adjai Crowther, and John Christopher Taylor arrived at the palace of Obi Akazua of Onitsha for courtesy call and formal introduction.

Dr. Baike requested to open up a trading station. Bishop Adjai Crowther asked for a piece of land to establish a mission station. The king welcomed them and granted their request. The agreement was sealed the following day with gun salute. A piece of land few kilometers from Onitsha waterside known as slave market

or slave beach was given to them to open up mission station.

**The CMS Niger Mission took off in earnest.** The first primary school in Onitsha was opened on Monday November 15, 1858, with 14 girls between 10 to 16 years of age. All were naked. Taylor gave them clothes. Boys showed no interest at all. Both day and night schools were opened by Taylor in 1864 for young slaves who became the school pioneers. Day school had 50 pupils and night school had 70 pupils on roll. Boarding house was maintained with funds from overseas charitable organizations. The most popular was “Coral Fund” sponsored by Miss Barber Brighton of England (Ekechi, 1971, pp. 6-8, 17). The aim of the fund was to enable the infant mission to maintain boarders at three pounds per child per year.

By 1864, attendance was 42 adults. In 1864, roll calls increased to 120—fruit of six years labour. By 1867 after labouring for ten years, attendance jumped to 310.

The Niger Mission was reinforced on December 5, 1885, when two Holy Ghost Missionaries—Father Joseph Lutz and the newly-ordained Father Horne and brothers Hermas and Jean—Gotto arrived at Onitsha waterside (Slave Beach). They were the pioneer Catholic Missionary team that comes to Onitsha to be ready to work in Igboland on the eastern side of the Niger. Trade disputes and internecine rivalries had been in existence between French and British nationals operating on the Niger. This Anglo-French rivalry made it suspicious and unsafe for any French man to be found on British area of influence.

It must be noted that on their way to the Lower Niger, they came across a kind-hearted protestant factory agent at Brass by name Charles Townsend who brought them in his own motor boat to Onitsha. The small boat was too small to take the four missionaries and their 70 pieces of luggage. For this reason, they hurriedly presented themselves to the King of Onitsha Obi Anazonwu and they went back to Brass to collect the two brothers and their luggage. On December 29, 1885, the four missionaries arrived safely at Onitsha.

In January 1886, the Fathers met the King and requested for a piece of land near Nkisi stream. This land had already been given to Anglican Bishop Adjai Crowther. The King sent the missionaries to meet Bishop Adjai Crowther who willingly surrendered the land to them:

“I acquired this piece of land for God’s cause. Take it”. This is the present site of Holy Trinity Cathedral Onitsha, about 20 hectares of land as they requested.

This marked the climax of the Holy Ghost Missionary enterprise in the Lower Niger. With Holy Trinity as the centre and node of diffusion and influence planting of Catholic Church in Igboland started. By 1889, Obosi, Ossomari, Nsugbe, Umuoji, Atani, Odekpe, and Nkwelle had received pastoral visit. Chief Nwanne Onyekomeli Idigo of Aguleri invited the missionaries to visit him. The RCM (Roman Catholic Mission) favoured expansion before consolidation unlike the CMS which wanted consolidation before expansion.

### **Bonny-Opodo and Cross River Axes**

On these two fronts, the missionaries ran into a belt of Izon (Ijo) and Efik-Ibibio peoples who presented barriers, opposition, and obstacles. They had to contend and conquer their souls before achieving the purpose of going into Igbo heartland. With passage of time, Igbo attitude to missionaries changed due to tragic clashes with political and military agents of imperialism. Peaceful penetration through these two coastal areas had to wait military action and conquest of the natives.

After the Aro expedition of 1901/1902 which destroyed the Long Juju of Arochukwu, the government invited all mission on the Niger to move in and establish their churches in the conquered territories. There was conversion explosion. From Bonny-Opobo, CMS spread to Umuahia, Ndoku, and Owerri.

Table 1

*Inventory of Igbo Science and Skills Involved in Their Application (Ngoka, n. d.)*

	Inventory of Igbo science processes	Skills required in their application
1	Industrial chemistry: Fermentation of substances for brewing; Soap manufacture, dyes, and ointments	Identification of substances, sorting, classifying, mixing, testing, tasting, inhaling, and preserving.
2	Medicine—Psychiatric treatment (voodoo: therapeutic practice using sympathetic magic and witchcraft). Clinical treatment using roots and herbs bark of trees: for bone-setting. Medical experts use healing properties of leaves, herbs, and bark of trees to cure diseases. Preventive medicine: Use of: (1) Clairvoyance—Bi- location, predictive validity/predictive ability, ability to see the future, or communicate with the dead or people who are far away; (2) Telepathy—Communicating with one another without print or non-print media or any other normal method of mass communication; and (3) Sorcery—Witchcraft.	Medicine men and diviners select medicinal plants and animals based on resemblance with the sickness/disease (Parrinder, 1949, pp. 16-17). Vitilago or leucoderma or spotted skin is treated using a plant with spotted leaf. Sharp quill feather was used to treat spiritual problem. This Igbo practice is called sympathetic magic. Sympathetic magic works on scientific principle of “like poles repel, unlike poles attract”, and “like produces like”. Medical skills include proper identification of herbs, preparation of extracts, mixing, administering treatment, and packaging.
3	Pharmaceutics—Manufacture of extracts, drugs, drug components, and preservation.	Identification of medicinal plants, useful plants, processing, grinding, grating, and squeezing.
4	Engineering—Metal work black smithing, iron smithing, brass work, and gold smithing.	Identification of metal type, cutting, melting, shaping, casting, and finishing.
5	Construction—Brick making, ceramics pottery, thatched roof making, and construction of silos.	Identification of appropriate raw materials, excavating raw materials. Treatment of raw materials, measurement, mixing, laying, moulding, drying, roasting, and storage.
6	Wood work—Carving and joinery (making of tools and implements with wood).	Measuring, cutting shaping, identification filing, painting, and polishing.
7	Agriculture and industry (crop cultivation).	Sowing yam seed, yam seed should not be buried too deep or too shallow in the ridge to facilitate germination mechanism. Cassava stem should not be turned downwards while sowing, otherwise germination will be hampered (Ukeje, 1966, pp. 19-23). Bush burning: For successful bush burning, farmer picked up a leaf, raise it up to know wind direction. Leaf turns forward or backward; indicating wind direction; thereby showing how to set fire to the farm (Fafunwa, 1991, pp. 31-34).
8	Soil science—Planting of shallow feeders and deep feeders.	Identification of fertile soil suitable for cereals and tubers in scientific skill. Push cutlass deep into the soil. If the cutlass jammed a stone in the subsoil, it shows the soil is not good for deep feeders like yam. Only cereals which are shallow feeders can thrive in the soil.
9	Seed germination—Condition for seed germination	Two tests were usually conducted to predict viable and non-viable seeds (Ukeje, 1966, pp. 19-23). First test: Soaking method—Seeds were immersed in a trough of water. Seeds that sank to the bottom of the trough were viable. Seeds floating on the surface of the water were non-viable. Second method—The experimental method. Seeds were planted in good soil. Early germination and growth showed viable seeds. Poor growth and etiology (pale colour) showed that the seeds were not viable (Fafunwa, 1991).
10	Salt industry—It was found in Uburn, Okposi, and Abiriba. These areas had brine lakes.	Only women were allowed to fetch the brine in pots. The brine was evaporated using smouldering fire under low temperature in special pots called “earthen jars”. The jars were filled to the brim with solid salt. The grains were so large that a pinch or two could season a pot of soup (Afigbo, 1981, pp. 31-33).

**Science process skills in Igbo culture.** Rich inventory of Igbo science and the science skills involved in their application have been documented in this study. As shown in Table 1, Ogundijo (1970), an authority on indigenous education and Afigbo (1981) identified three basic economic activities in Igboland—agriculture, trade, and industry (Ogundijo, 1970, pp. 11-24; Afigbo, 1981, pp. 124-139). Out of these, the researchers

distilled 10 economic activities and science process skills involved in their application as a platform to establish science process skills in Igbo culture (Afigbo, 1981, pp. 7-10).

### **Globalization and Science Education**

Globalization: It refers to fast shrinkage of the world due to global system of mass communication, Internet technology, or digital revolution. The present challenge facing Igbo nation is how to relate Igbo scientific culture to life in a globalized world. Igbos in Nigeria have started to experience digital revolution. But the average Igbo youths lack basic mechanical orientation necessary for survival in an age of high information technology and technological culture. No one can afford to use yesterday tools to do today's business and hope to be in business tomorrow (Muogbo, Aiyesimi, & Okoli, 2006, pp. 22-26). Old order "changeth" must yield places to the new. God fulfills himself in many ways lest one good custom corrupts the world".

As days roll by, new skills are acquired and dire need for up-skilling and de-skilling arises. It becomes necessary to teach new skills from generation to generation. Informal education (indigenous education) is no more adequate. Semi-formal education is obsolete. Formal and non-formal education now take the centre stage.

The very defect, weaknesses, and short-coming in Igbo scientific culture is that right from July 26, 1857, when the CMS (Anglican) Niger Mission arrived at Onitsha Water side, the entire education offered to the Igbos by the agents of imperialism was geared towards aping the British classical tradition. The system was entirely divorced from the life and culture of the people. Education was the acquisition of inert knowledge. Such knowledge remained only in its "ivory tower" (Ukeje, 1966, pp. 78-82). Schools existed to impart knowledge with little reflection. Ukeje (1966) continued to lament—"Schools taught children what to think not how to think. Children learnt to memorize but not to digest; and to adopt not to adapt. Children could solve problems with memorized formula but could not solve simpler ones without formula" (p. 79).

Considering Igbo inventiveness and creativity, intelligence and business acumen, the Igbo is an asset and a special gift to Nigeria. The Igbos possessed a stuff great civilization harnessed for their greatness. Biafran/Nigerian war of 1967-1970 brought conviction to all friends and detractors about technical ingenuity which produced a landmine called OGBUNIGWE (Igbo constructed rocket which is also a mass destroyer). This was a demonstration of dynamic explosive superhuman dynamite. This landmine was produced with empty tins of milk. Time and scope do not permit us to delve into another Biafran prodigy known as "do it yourself oil refinery" at Azia (a town in Igbo land), and of course Uli (a town in Igbo land) international airport which were killed with Biafra. Philip Emeagwali, an Igbo Computer prodigy, now the best computer scientist globally acknowledged is an Igbo from Ogbaru few kilometers from Onitsha. He schooled at Christ the King College Onitsha and he has made Igbo history a world history in computer science and technology.

Igbo nation, a nation in the making, with wonderful possibilities for technological breakthrough and industrialization has many jungles to clear, impediments to remove, and challenges to address. With the present global changes in science and technology, Igbo education system must change to be in keeping with the ongoing digital revolution across the globe. Integration of Igbo scientific culture into a globalized world will begin with science in primary schools.

The very need is inculcation of scientific attitude and science process skills in children quite early in life. Ignorance and superstition must be removed early in life and be replaced with scientific attitude and behaviour (Ukeje, 1966, p. 137). Primary school must infuse in children the habit of curiosity searching and testing. Top priority must be given to science. Science, according to experts at primary school level, is not teaching

chemistry physics and biology. Rather it is making children become aware of daily occurrence around them. This implies making children begin to ask questions, such as:

- (1) Where do babies come from?
- (2) Why is mummy's Tommy swollen?
- (3) What is inside your big belly, mummy?
- (4) How does water enter into this coconut?

Science skills here are merely helping children appreciate natural phenomenon and the world around. The aim of primary science is to make the child be conscious of the world around him and create a sense of curiosity (Ukeje, 1966, pp. 135-136). Inquisitiveness and curiosity are among the innate propensities in man which can be exploited in developing scientific attitude to life. Children should be guided to find answers to their inquisitiveness and curiosity. School should develop in children early in life an idea of cause and effect relationship, attitude of searching, testing, analyzing, making inferences, and drawing conclusions (Ukeje, 1966, p. 135).

Educators should not lose sight of the history of primary science. Poor sense of history among educators should not be encouraged. Elementary science education started in Nsukka, Igboland in 1963 (Fafunwa, 1991, p. 189). This scientific reawakening started with launching of Russian Sputnik in 1957. Science became the desire of all nations. America launched elementary science in its primary schools. With this Nigeria captured the zeal as championed by Nsukka, followed by Nigerian Educational Research and Development Council (Former NERC). Later, Ministry of Education stepped in. At this stage, emphasis was on local materials and improvisation. One would have thought that Igbo science and technology should take the pride of place. Years of brainwashing and colonial mis-education wrecked havoc on this expectation. However, the use of bamboo microscopes and bamboo cages became an innovative technique in modern science delivery. Early Igbo scientists remained silent over the revival of the numerous Igbo scientific culture. Oddly enough, they pursued new developments in science and mathematics led by American EDC (Educational Development Centre) in Newton, Massachusetts in 1962. The EDC organized series of workshops between 1962 and 1967 resulting in curriculum innovation culminating in the launching of Entebbe mathematics. Nigeria played a leading role in the popularization of new mathematics popularly known as modern mathematics.

No Igbo scientist championed the cause of revamping Igbo science culture. Britain did not leave American innovation to go unchallenged. Nuffield mathematics was launched by United Kingdom and was marketed in Igbo secondary schools. Igbo science was neglected. There is need for a re-discovery of Igbo cultural heritage. Western education contributed immensely to the atrophisation of Igbo scientific culture. Igbo parents educated their children before the coming of the Whiteman. Indigenous education is not dying; instead it is growing and flourishing. A concerned academic historian was once quoted as asking the following questions:

- (1) How long shall western education and indigenous education work at cross purposes (working in isolation)?
- (2) What aspects of indigenous education can be integrated with western education?
- (3) What would have been the fate of Igbo science if western education had not been superimposed on it? (Ukeje, 1966, pp. 118-146).

It is not only the primary science discussed above that can play a role in the work of integration of Igbo science into the globalized world of 21st century. All hands must be on deck. Secondary education and the scientific culture imparts must be involved. It must be concerned with issues of this day and computer age.



Indigenous science will not be allowed to suffer atrophy. Secondary level of education should champion the reconstruction of indigenous scientific culture. It is not expected to be a conduit for transportation of neo-colonial education. The issue is not the neo-colonial curriculum of today.

The important thing is the “use to whatever knowledge acquired from whatever curriculum is put” (Ukeje, 1966, pp. 118-146). Everyone knows that education is not an end in itself. It is a means to an end. The end in this context is the use one makes of acquired knowledge for scientific revolution. What is desired is that the knowledge gained should be put into use (transfer of learning). It is not knowledge for ornamentation—wearing all that weight of learning lightly like a flower.

It is believed that a course of study in ancient and medieval history or Graeco-Roman literature is not a waste as some ill-fated critics of European history would want us to believe. If the knowledge acquired from this foreign culture and tradition is used to address similar problems in our own education system then this goes down in history as progressive education:

(1) How can the knowledge of Graeco-Roman literature and its scientific culture make Igbo indigenous science meaningful and relevant in a globalized world of digital revolution?

(2) How can this knowledge give sense and direction, meaning, and realism to Igbo scientific culture vis-a-vis the challenges of globalization?

### **Challenges of Globalization**

Many challenges can be envisaged:

Research is needed to find out industrial possibilities of local scientific activities. For instance, the industrial production of “garri” and manufacture of diesel oil from palm oil is desirable in achieving global recognition (Ukeje, 1966, p. 23).

Igbos have professional and supportive staff here and there but painfully lacks a “core staff” who can render selfless service without the dreaded double standard of ethics and morality. The actual need to take Igbo science across the globe is the development of people with high sense of patriotism able to serve “prodei et patria” (for God and Fatherland). Development of people with a sense of public obligation and willing to perform public service with humility, integrity, and honesty is a serious challenge. Many highly-talented Igbo youths in Diaspora are the bedrock of foreign economy; whereas their talents and expertise are badly needed at home.

There is need for integration of traditional elements into new production techniques—building on the old and reflecting global changes (harmonious blending of the old and the new).

Teaching of machine habit and machine orientation (Ukeje, 1966) must be intensified. If Igbo science will be integrated into the present needs of globalized world. There is need for sufficient production of lime and artificial aids for increased food production and productivity in order to meet the challenges of globalized world.

Moreover, to integrate Igbo science into the globalized world of the 21st century, science curriculum should be flexible. This will enable students to internalize scientific attitude of life. Science schools should give students basic concepts, abilities, and skills, they need for entering into the global system of mobile communication.

A lot of barriers to ICT (information communication technology)-based interventions exist. The barriers constitute hindrances to technology integration. Digital “divide” problem—differences in provision of Internet

facilities to students and teachers are real. Limited funds for establishing Internet institutions are a serious setback. Cost of a typical multimedia personal computer is great. It is beyond the reach of average teacher in Nigeria. Poverty level is high. Connecting individuals to global village is expensive. Microwave telephony or other alternatives are also expensive for an income earner.

Availability of electricity and telephone is a serious barrier to ICT-based intervention. Power supply in Nigeria is epileptic and very unreliable. Power is available one hour a week in lucky districts. Majority of the areas remain in total darkness or blackout for months. Generating capacity of 11 power stations in Nigeria is 6900 MW. The power stations include: Afam, Delta, Egbin, Gerugu, Ijora, Jebba, Kainji, Olorun sogo, Omotosho, Sapele, and Shiroro.

Out of the expected 6,900 MW, a generating capacity of 3,500 MW is available. But South Africa with a population of 49 million people generates 42,000 MW of electricity. Nigeria with a population of 150 millions generates 3,500 MW.

The National Planning Commission stated that Nigeria's energy requirement as at December 2010 was 20,000 MW. It is clear that Nigeria cannot give the citizen adequate power supply in a foreseeable future. How can science and technology in Nigeria meet the challenges of a globalized world under the present power situation? (Dipo, 2011, pp. 1-4).

### **Implications**

From the above analysis, it is clear that many teachers and learners cannot access information from Internet. Teleconferencing or computer conferencing which reduces travel risk and expenses by making teachers in distant place talk face to face ever television linkup is not available in Nigeria. This ICT approach cannot be used in Nigeria.

World knowledge base doubles every two years at least. Advancement in ICT opened new trends and approaches in teaching and learning. No one can afford to use yesterday's tools to do today's business and hope to be in business tomorrow. Teachers all over the world are re-engineering their classroom operations to meet the challenges posed by ICT so as to remain relevant in the labor market (Muogbo, Aiyesimi, & Okoli, 2006, pp. 22-26).

The era of teachers without ICT skills is gone. Knowledge without Internet is poor and unacceptable today. Everyone is adjusting to fit into the new information superhighway and be relevant in the global trend. Anybody not part of the global trend is left behind. Everyone has to adjust to a world that has become science and technology driven.

ICT approach, therefore, has implication for human resource development and technological gap management.

### **Summary**

This study focused on historical foundation of science education in Igbo society as well as the challenges facing its integration into a globalized world of digital revolution and Internet technology.

ICT has revolutionized the way people think, live, teach, and work together. Traditional method of teaching and learning has given way to virtual classroom where ICT skills are used, so as to fit into globalized world of information superhighway.

New technologies are introduced almost on daily basis. The challenge is how to catch up with these

developments and keep up with the pace of development/globalization. World knowledge base doubles every two years. Changes in science teaching and learning process must follow to prepare students for information and technology based society. Another challenge is how to change teaching and learning process to give students skills that will help them operate in a dynamic information rich continuously changing environment. This calls for training and retraining as well as continuous human resource development and capacity building efforts.

### Recommendations

Science teachers have to develop innovative approaches to ensure continuous re-tooling and re-engineering of science teaching and learning as well as capacity building of teachers so that they can operate at the cutting edge of science and technology.

Traditional method of teaching and learning has to give way to e-learning platform where ICT skills and technologies are used. Functional Internet facilities must be installed, so that teachers and learners should be able to access information from other parts of the world.

Internet must be cheap and accessible. Collaborative research has to be encouraged as recommended in the conference communiqué of science educators (Ijah, 2006, pp. 19-23). Individual research effort should be discouraged as this does not promote fast development. Nigeria must wake up from slumber of years and embark upon adequate power supply.

There must be e-learning readiness in science institutions in Igboland. There is need to develop a flexible NQF (National Qualifications Framework) to address the issue of rapidly changing continuous demand for new skills (up-skilling and de-skilling).

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