

ISSN 1596 - 6224

Global Journal *of*

EDUCATIONAL RESEARCH



Vol. 10 , No 2 2011

Global Journal online:
<http://www.globaljournalseries.com>
Indexed and Abstracted
on
AJOL(S. Africa) <http://www.ajol.info>

CHANGING STM CURRICULA FOR THE INFORMATION AGE: IMPLICATIONS FOR THE TEACHER

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(Received 7, March 2011; Revision Accepted 1, August 2011)

ABSTRACT

The explosion of knowledge in global information society has necessitated a shift of emphasis from industrial finite resource economy to knowledge base economy using information and communication technology (ICT) as platform. This calls for a change in every field of life endeavour. Consequently, the current trend in education is on how to utilize the pervasive tools of ICT to improve education at all levels since education has been recognized as an instrument for change. This paper, therefore, tried to examine how science, technology and mathematics (STM) curricula can be modified to effect such changes. In doing this, the paper tried to look at the challenges of STM education in information age, rationale and strategies for changing STM curricular, implications for the teacher and then conclusion.

INTRODUCTION

The concept 'curriculum' has been given various definitions by many scholars. Three major points that run across all the definitions remains that curriculum is:

- (i) an educational programme of experiences;
- (ii) offered to a learner; and
- (iii) for effecting changes in the behaviour of the learner in the desired direction.

Curriculum, as Ivowi (2009) puts it, is a tool designed for educating a person in order to change the orientation, behavior, action and value claims to that of a good person whose concern is to develop both self and also the world around him. This definition is apt for science, technology and mathematics (STM) curricula and timely for the information age with its challenges that are staring at individuals, groups, communities and even nations for changes. In the context of this paper, curriculum can be defined as a learning package designed for the learner under the guidance of a school to effect a change in the learner towards the desired behaviour.

In this information age, the global trend is on information and communication technology (ICT) and so the curriculum has to reflect this by effecting changes in the learner in that direction. Changing of STM curricula therefore, involves re-engineering, revamping and re-equipping STM curricular with the aid of some essential ingredients that the current information age could offer to facilitate better qualitative education.

Information age is simply the age of computer and other forms of communication characterized by acquisition, analysis and communication of information system. This has resulted in knowledge explosion that is changing the world continually with vast new ideas. Consequently, many challenges accompanying these changes have to be attended to by modifying the traditional school curriculum to match the trend of technological development across the globe.

Education has been recognized as an instrument for veritable change as documented in the National Policy on Education (Federal Republic of Nigeria, 2004) which refers to education as "the most important instrument of change, as any fundamental change in the

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intellectual and social outlook of any society has to be preceded by an educational revolution" (Section 1, subsection 9:9). For STM education to engender the magnitude of changes that will ensure that the challenges of the 21st century knowledge-based society are met, it becomes necessary that the curriculum be changed to reflect current realities.

The world of the twenty-first century knowledge-based society is the age of information and communication technologies referred to as the information age. Isoun (2003) submitted that no work of science in the history of human development has so comprehensively impacted on the course of human development as ICT. It is undoubtedly the greatest agent of change of this century, altering every aspect of human life and not only education.

The emergence of knowledge-based society in the 21st century together with increasing globalization and rapid technological changes has posed many challenges to every aspect of life endeavour. According to Agabi in Ahamfula (2008), changes in information and communication technologies have created skill-obsolence and brought new techniques and knowledge explosion. Characterized by three major factors which include knowledge explosion, rapid technological change and globalization, the modern global trend in education is evolving to effectively integrate and use ICTs in the implementation of the school curriculum. This calls for alteration in the Nigerian school curriculum in its totality if education is to be used as an instrument of change.

Education according to Holbrook (2008) is the central theme in our lives. "Education is widely recognized as the pivot on which all development rests" (Nebo, 2008); while science, technology and mathematics are the corner stone for development. There is no gainsaying that STM hold the key to sustainable development in almost every field. According to Abonyi and Okoli (2009), STM education is known as the wheel that drives all aspects of the economy. This was corroborated by Azuka in Animalu and Harbor-Peters (2002) thus: Mathematics → Science → Technology → Development → Progress. This implies that science, technology and mathematics bring development and development leads to progress. Application of STM is of paramount importance to rapid growth and development and even progress of the nation. Since curriculum serves as a tool for school activities/programs, STM curricula need to

be restructured within the context of globalization by engendering some changes/modifications. Specifically, the major issues that are addressed in this paper include:

- challenges of STM education in information age;
- rationale for changing the curricula;
- strategies for changing STM curricula;
- implications for the teacher.

Challenges of STM Education in information age

The unprecedented surge in knowledge the world over today catalyzed by advancement in science and technology has posed a lot of challenges to every sphere of life. In the educational sector, the challenges faced are that of extending educational opportunities to all and enhancing the effectiveness of traditional school system in meeting basic needs. Specifically, some of such major challenges are discussed below.

One of the major challenges facing education generally and STM education particularly is finance. STM education requires a lot of money especially at the planning and the implementation stages of its curriculum delivery. This becomes even compounded with the use of new technological devices like computers, internets, CD-ROM, computer assisted instructions etc. for curriculum delivery. Funds are grossly inadequate at all levels of education for the purchase and use of these facilities. Although efforts are being made at various levels by Federal and state governments, non-governmental organizations, old students associations and some philanthropists to provide schools with some of these new technological devices, the supply is inadequate. The cost of procuring some of these devices like computers is exorbitant and so not easily affordable by schools. This has paralyzed STM education as most of the activities are still performed in their very traditional ways devoid of the new technologies. On the other hand, STM teachers are not well equipped as they cannot afford to buy laptops on their own for their teaching; they are neither given loans nor assisted to buy at a subsidized rate.

Another strong impediment to effective STM education in information age is irregular/epileptic supply of power for use of ICT material. Computers and other electronic equipments such as television, video recorder, etc. function well with regular and adequate supply of power. Power Holding Company of

Nigeria (PHCN) has not impressed Nigerians with power supply. This is a serious challenge to STM education especially in the information age. Cases of damages of electronic equipment due to fluctuation of voltages of electricity abound. Purchase and maintenance of generators as an alternative means is equally not cheap to come by thereby paralyzing the use of these ICT equipments. Generation of energy from the solar system for stable and regular supply of energy is not yet very functional hence a further challenge to STM education.

Limited access to internet also constitutes another problem to ICT usage in this information age. Internet providers in the country are not just enough. Consequently, some companies provide very poor services to customers, and may even exploit and defraud them. The few that render reliable services have resorted to charging high fees thereby limiting access to the use of the internet.

Lack of qualified and competent personnel for the use of ICT materials in teaching-learning process also constitute another challenge to STM education in the information age. The use of ICT equipments and materials like computers, internet, sensors, CD-ROM, videos, digital camera etc., requires some skills/technical know-how for optimum results in STM education and this is grossly lacking among our teachers. Trained personnel in software application, operating system, network administration and technicians for serving and repairing of ICT facilities are grossly inadequate. These factors among others are the challenges of STM education in the information age and, therefore need to be addressed for good quality STM education. Although changing of the curricular alone might not address all the challenges that are associated with the information age, it will go a long way in alleviating some of them since it is a tool designed purposely for effecting changes in the learner.

Rationale for Changing STM Curricula

In education practice, the curriculum – a social engineering arena changes with societal changes across the globe. Curriculum planning at every level becomes meaningful only when global changes are taken into consideration. The dynamics of the global economy have been changing due to great advances in computing and communication technologies (Adiukwu, 2008). Consequently, markets for labour, goods and services are integrating across continents

thereby becoming larger. For students to be prepared for the global market, the curriculum planning and delivery have to be in line with the trend globally; hence, the changing of STM curricula for information age.

On another angle, one of the goals of education as documented in the national policy of education is the acquisition of appropriate skills and the development of mental physical and social abilities and competencies as equipment for the individual to live in and contribute to the development of his society (FRN, 2004, p8). The present knowledge- based society refereed to as information age is characterized by knowledge explosion. Consequently, modern education is centered more on ICT as a platform. The appropriate skills and competences that individuals should be equipped with as one of the goals of education should be that of ICT. This should help them live and contribute/compete effectively in the society and in the emerging global village. This can only be achieved through changing of educational curricular, hence the changing of STM curricula for the information age.

Strategies for Changing STM Curricular for the Information Age

ICT is an innovative means of reforming teaching and learning that stimulates learners to learn actively and independently in the information age. Changing STM curricular for the information age will, therefore, involve using ICT to improve the curricular practices in both planning and delivery stages so as to align with the global trend. Considering the fact that ICT involve the whole range of telecommunication technologies used in information processing and electronic communication, strategies for changing STM curricula, therefore, will revolve around integrating ICT education into STM curricula practices. This implies learning about ICT and learning with ICT and through ICT. Learning about ICT entails teaching about ICT which is called topicality (Collins & Moonen, 2001). Teaching about ICT means teaching ICT as a topic. In ICT, the contents of the STM curricular should cover many aspects of ICT especially mastery of the computer. According to Ofele (2008), teaching computer implies covering many aspects of ICT like computer hardware, software, operating system, application programmes, wireless communication, networks etc. in the content of curriculum. These and even more aspects of other technological devices of ICT

should be included in STM curricula contents for acquisition of knowledge and skills needed in the information age. Acquisition of knowledge and skills for use of these technological devices are very important to both teachers and students not only for the teaching-learning processes but to be in line with the globalizing world in equipping the tomorrow employees and customers with the requisite competence and knowledge to use ICTs within their work.

Teaching with ICT or through ICT involves presentation and distribution of instructional content through web environment or systems offering an integrated range of tools (stand-alone computer instructions, CD-ROM among others to support learning and communication) (Yusuf & Onasanya, 2004).

On the other hand, learning with ICT means using ICT materials in instructional delivery process, in other words, to teach STM with ICT materials implies employing the whole range of technological devices like computers, sensors videos interface boxes, email, satellite connections, radio, televisions etc. in the teaching and learning of STM. STM curricula need to be altered so as to accommodate technological devices for maximum output. The importance of instructional material/resources in teaching-learning process is not debatable. Science for instance, is an experimental subject that requires the use of these technological devices as instructional materials/resources for their understanding and application in addition to knowledge and skill acquisition. Appropriate integration and use of these devices in the STM curricula for the teaching and learning of STM should be part of the strategies for changing STM education.

Implications for the teacher

The teacher remains a very crucial element as far as curriculum planning and implementation are concerned. No matter how well planned a curriculum may be, it will be fruitless if the teachers that are to implement it are not competent enough. Considering the fact that ICTs are becoming part and parcel of man's daily life, their use in education by staff especially the teaching staff and their students becomes expedient. STM teachers need to be very comfortable with using it even to a higher degree in their present and future academic activities.

Computer is one of the major aspects of ICT equipments that should be covered in the contents of the curriculum. Teachers should possess some basic knowledge and

technological skills associated with operating systems as resource management. For instance, the teacher should be knowledgeable in computing operational skills in addition to the knowledge of the devices associated with input, processing, storage, output and communication operations. Unfortunately, teachers cannot do that without the availability of necessary ICT materials to work with. The implication is that those concerned should help in the provision of ICT materials to work with. They should also provide ICT materials for teaching and learning in STM. Possession of laptops by every teacher at the different levels of education is very necessary for the teachers' effectiveness and efficiency for high quality layouts that will be at par with desired global standard.

Teachers are, therefore, expected to develop some competencies in the use of ICTs to enhance teaching and learning competencies such as personal, subject and teaching competencies. Sellinger and Austin (2003) described personal competencies as involving skill, knowledge and understanding of when, when not and how to use ICT effectively in teaching a subject; i.e. skills in functions, operational use and compatibility of ICT which support teaching. Subject competencies as knowledge of the functions, operations, use and features of ICT and how ICT can be used to support teaching and learning, and teaching competencies as the ability to plan, prepare, teach, access and evaluate lessons in which ICT could be seen to be supporting a range of suitable learning outcomes.

In spite of ICT recognized potentials, their integration in teaching-learning processes as a means of changing strategy will be highly dependent on teachers knowledge, competences and willingness to integrate ICT in their teaching.

CONCLUSION

Information and communication technologies have come to stay and their potentials for change in teaching and learning are recognized. Considering the penetrating impact of ICT on every facet of human endeavours and the importance on ICT in STM education in national development especially in the information age that is ICT driven, it becomes very expedient that the curricula be changed to face the challenges brought by ICT and to conform with changes brought about it too for effectiveness and efficiency in STM teaching-learning processes. While curriculum planners and all stakeholders in STM place their hands on

the deck to see that the curricula are changed to align with the demands of the information age, teachers that are the curriculum implementers need to be adequately prepared and equipped for the take off and sustenance. Teachers need to be competent not only in the use of a variety of software like word processing, data processing spreadsheet and so on but also in the use of some software that have specific application in their various disciplines e.g. SPSS for teacher in statistics, education etc. to enhance their output. Teachers have to be encouraged to develop the needed skills in the use of ICTs and to develop positive attitude towards their use for teaching and research.

In conclusion, the researchers recommend that all teachers' training institutions in the country, should by way of extension, restructure their programmes for ICT capacity building. As a matter of urgency, both Federal and state governments should map out programmes that should compulsorily compel teachers at all levels to be computer literate.

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