

**INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN HUMAN RESOURCE
DEVELOPMENT: ISSUES IN NIGERIA CERTIFICATE IN EDUCATION (NCE)
COMPUTER SCIENCE CURRICULUM**

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Abstract

This paper highlighted the importance and unquestionable position of Information and Communication Technology (ICT) in our present day society. Educational computing as an aspect of ICT was specially considered. The Nigerian Certificate in Education (NCE) computer science curriculum was looked at. The paper further considered the human resource development as it affects the NCE student teachers in relation to computer science. Other very important emergent issues were also pointed out.

Introduction

In the whole world, Information and Communication Technology (ICT) is virtually putting smiles on faces of individuals, organisations, nations and people as well as groups who are applying ICT in processes and everyday life. Due to this application, several nations' economies have dramatically improved.

The term, Information Technology, has been commonly used in business and industry for some times as a synonym for '**computer technology**'. There has recently been a move in education in Britain and New Zealand, however, to use the phrase information and communication technology, with the intention of emphasizing that much more than computer is involved. By using this phrase, we are making it clear that we are also talking about such things as fax, telephone, video and so on. Hunt (2003) argued that this is unnecessarily tortuous, since the study of information, must necessarily include the study of its communication. Nevertheless, one must be aware of the slightly different usage in education and be prepared to explain it to parents and the community as the case may be.

Information and communication Technology (ICT) is therefore understood to be a complex of artifacts, techniques and knowledge for solving human problems involving information and its communication. In most general sense, it includes the use of computers, quill pens, semaphore and satellite.

Information and communication Technology therefore is a convergence of various technologies ranging from electrical/electronic engineering, computer science/engineering and telecommunication. These have been merged into one single field today, which has wide application in all facets of human endeavors such as medicine, engineering, finance and education

Iji (2003) opined that ICT as a tool has been the most important application of computers in education. Isoun (2003) also averred that in the history of civilization, no work of science has so comprehensively influenced the course of human development as ICT. Undoubtedly, ICT has been the greatest change agent of this century and promises to play this role even more dramatically in the coming decades. No wonder, educational computing is expanding in popularity in our classrooms today.

Teacher Education must prepare its candidates for future service in educational institutions. It is becoming increasingly apparent that the future of both individuals and nations are intricately tied to computers. Our future educators must therefore, be equipped with the knowledge, attitudes and experiences, which, they can use in classrooms of the future. These, must not be overlooked as they affect the contents of the NCE Computer Science curriculum. The NCE programme is primarily designed for individuals who after graduation are expected to teach at the primary schools and at the junior secondary schools. The supposed responsibilities of the NCE graduates necessitate a proper definition, management and possibly evaluation of the teacher educational curriculum for computer science. One therefore cannot shy away from such matters as human resource development as it affects these teachers in training, the NCE computer science curriculum as well as some vital issues that are emergent.

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Human Resource Development

The general goal of effective human resource development is to provide continuous and proper staffing. It also aims at ensuring that appropriate skills are made available within the workforce, when needed to meet the organization's changing requirements (Bitten & Ramsey, 1995). It therefore appears that the need to develop the human resources available or source for development become more pronounced at this time of challenging changing technology. This may as well be because organizations may through this exercise meet up their human resource obligations to the yearning society for their services.

To achieve this particularly in the school system, there arise the need for an acceptable curriculum. The new Webster's dictionary of English language defines curriculum as a course of study especially at school or collage. That it involves the courses offered at a school, collage or university. The implication here is to develop a curriculum that will actualize the desire and yearnings of the people toward acquiring a satisfactory ICT knowledge that will match up with the dictate of the populace. This means that the selection and organization of the intended learning outcomes must be carried out with diligence.

Good curriculum and instruction make significant contribution to academic success of all students - both advantaged and disadvantaged. Specifically, secondary schools with solid records of student achievement, engage them in work that is challenging and worthwhile; work that builds on their prior experience and knowledge as well as demonstrates the connections between schoolwork and the outside world. Teachers in these schools use approaches that involve students as procedure of knowledge, rather than as passive recipients. Community service learning and students' own interest play very important role in shaping curriculum. The obvious importance of these variables resulted to educators being inquisitive to ascertaining whether the introduction of computers in the classroom has a significant and reliable impact on students' achievement. Though judging the impact of any particular technology may require an understanding of how it is used in the classroom as well as what learning goals are held by the educators involved. Again, knowledge about the type of assessments that are used to evaluate improvements in students achievement and awareness of the complex nature of change in school environment and the entire society may become very necessary.

All over the world, stakeholders in education are developing and implementing technology pians and investing in computers and other new technology. Particularly educators come to realize that **computer networking** offers flexible and very powerful new ways to accomplishing a range of goals that have been important in schools. Such goals include gaining access to a universe of informational resources, establishing contact with students and professional in other places and cultures, and putting teachers in touch with a broader community of educators in their disciplines.

This boils down to the fact that various technologies deliver different kinds of content and serve different purposes in the classroom. For instance, word processing and e-mail promote communication skills; database and spreadsheet programs promotes organizational skills; modeling software promotes the understanding of science and mathematics.

Here stands out the fact that technologies available in classrooms today range from simple tool-based applications (such as word processors) to on-line repositories of scientific data and primary historical documents, to close - circuit television channels and two way distance learning classrooms. Johnson (1997) described four major ways technology is used to support learning. He stated that: Technology can be used as a tutor (examples are drill and practice software, tutoring systems, instructional television, computer assisted instructions and intelligent computer assisted instructions). (2) As a means to explore (examples are CD - ROM encyclopedias, simulations, hypermedia stacks, network search tool, and microcomputer based laboratories). (3) As a tool to create, compose, store and analyze data (examples are word processing and spreadsheet software, database management programs, graphic software as well as desktop publishing system). (4) As a means to communicate with others (examples are e-mail, interactive distance learning through satellite systems, computer and modern, and cable link) (pp2-3).

The implication of the above four - dimensional position of Johnson is that the curriculum in question must take a holistic consideration of its beneficiaries. It must therefore, be able to enable

Information and Communication Technology (ICT) in Human Resource Development: Issues in Nigeria Certificate Education (NCE) Computer Science Curriculum

students engage in meaningful exploration, thinking, reading, writing, researching, inventing, problem-solving as well as experiencing the world.

The challenging nature of technology offers a huge array of opportunities and resources. This means that students must improve upon their achievement and variables mentioned above. Used effectively, technology can encourage collaborative learning and development and critical thinking skills. It can equally help learners explore the world beyond the classroom by providing access to vast resources and information, promoting scientific inquiry and discovery and allowing students to communicate with experts. Technology used for authentic tasks can provide students with opportunities to interact with a wealth of resources, materials, and data sets, and to perform challenging tasks similar to those in careers and out- of -school activities. The school system is therefore, saddled with the responsibilities of preparing students who should actively use the computer as a problem-solving tool and apply computer science principles to data organisations. Their technical know-how should be developed to the extent of being adequately aware of the import of information technology in an ever-changing world. All what have being observed and said so far have implication for the Nigeria certificate in education computer science curriculum. This is because the NCE teachers are to teach at the primary and junior secondary schools, which are the foundation of our educational system.

National Certificate of Education (NCE) Computer Science Curriculum Content

The NCE teachers are set of individuals produced and saddled with the responsibility of teaching at the primary and junior Secondary school levels. Adequate tutoring of the NCE students would enable NCE graduates have the capability to communicate and teach computer. The computer is the activator of any advancement in information and communication technology at any level (Egede, 2003).

Primary education is the education given in institutions for children aged 6 to 11 plus (FME, 1998). This document emphasized that since the rest of the education system is built upon it, the primary level is the key to the success or failure of the whole system. The goal among others, of this level of education is to lay a sound basis for scientific and reflective thinking. This has a serious implication for the nation's technological development.

The secondary education is the education children receive after primary education but before the tertiary stage. The boarder goals of this level of education are to prepare the individual for:

- a) Useful living within the society; and
- b) Higher education.

This level of education is divided into two tiers- junior and senior secondary schools. Since the focus now is the first tier, nothing will be said about the second tier.

It is recognized that secondary school level consolidates basic learning experiences introduced at primary schools. The secondary schools level also lays foundation for tertiary studies and for a vocation within the society. For this reason the computer programme at the junior secondary (JS) level should provide similar experience as those identified for the primary schools. That is:

- The initial content of this level should expose the students to computers and their uses in everyday life.
- They will be able to use computers to facilitate their learning processes and problem-solving behaviour.
- They should be able to appreciate the nature and role of computers in the dynamics of information age.
- Appreciate the importance of modern computer hardware and software and its associated peripherals.

From the foregoing, it becomes pertinent that the job before the teacher is eminent. We are aware that the role of the teacher in any educational programme is crucial. This is because, it is the teacher who takes charge of programme after the adoption and introduction of the curricula. Hence, the over-all success of the computer programme will depend on the quality of training that the teacher receives and in his/her innate ability to use, adopt and improvise curricula content. The national policy on computer education (1988), therefore, posited that it is expected that the NCE and graduate

teachers will bear the brunt, of teaching about computers at both the primary and secondary education levels. The implication being that the training requirements must be thorough and comprehensive. The policy therefore stated that the objectives of computer education at the level of NCE teachers are that they would be:

* Generally conversant with and able to use any curriculum developed for the programme.

- Train teachers for primary and junior secondary level.
- Provide opportunity for the re-training of the nation's teachers.
- Acquire skills necessary for proper management of computer laboratories.
- Be able to develop and write simple programs in any of the high level languages.

Scope

The minimum standards for NCE teachers as published by the National Commission for Colleges of Education (NCCE): made efforts in providing a package, which was aimed at achieving the national goal of technological development. The topical scope and sequence gives the reader an overview of the specific objectives as they occur in each of the courses. Depending on the amount of integration, flexibility with the sequence is permitted. Core topics and timeless have been indicated. The choice of optional topics and timeless is a local decision within the minimum of 36 and maximum of 130 instructional hours for the course.

Many research studies indicate that instruction in computer science should regularly demonstrate its applicability to real- life. Therefore, even though the students learning objectives are detailed separately, they are intended to be taught in an integrated fashion. As problem solving is an integral component of computer science, it is to be incorporated throughout the programme. Table 1 shows NCE computer science curriculum as provided by the (NCCE, 2002).

Table 1: Course Content and Status

j Code & Num.	Course Title	Unit	Status
CSC 111	NCE 1 First Semester Introduction to Computer Science	2	C
CSCI 12	BASIC Programming Language	2	C
CSC 113	Computer Operations & Application	2	c
CSCI14	Number system	2	c
	Total	07	
	NCE 1 Second Semester		
CSC 121	Electronic Data Processing (EDP)	1	c
CSC 122	FORTRAN Computer Programming Language	2	c
CSC 123	Electronic Spreadsheet & Word Processing (with MS Excel & Ms Word).	2	c
CSC 124	The teaching of Computer Science 1	2	c
CSC 125	SIWES	1	c
	Total	08	
	NCE 11 First semester		
Either CSC211	Introduction to symbolic logic	1	E
OR CSC212	Introduction to Operation Research	1	E
CSC213	Database Management 1	2	C
CSC214	Data Structure	1	C
CSC215	Computer logic	2	c
	Total	07	
	NCE11 Second Semester		
CSC 221	PASCAL Programming Language	2	c
CSC 222	Operating System (OS)/ Windows App.	2	'C
CSC 223	Introduction to Number Methods	1	C
CSC 224	The Teaching of Computer Science 11	2	c
CSC 225	SIWES	1	c
	Total	08	
	NCE111 First Semester		

Information and Communication Technology (ICT) in Human Resource Development: Issues in Nigeria Certificate Education (NCE) Computer Science Curriculum

CSC 311	Computer Maintenance/ Troubleshooting	1	C
CSC 312	The Microprocessor	1	C
CSC 313	Database Management 11 with Dbase for windows	2	c
CSC 314	System Analysis & Design	1	c
	Total	05	
	NCE 111 Second Semester		
CSC321	COBOL Programming Language	1	c
CSC 322	Seminars	1	c
Either CSC 323	Desk Top Publishing	1	E
OR CSC 324	Computer Graphics	1	E
CSC 325	Introduction to Networking	1	C
CSC 326	Final Year Project	2	C
	Total	07	

Summary of course title and status.

Source: NCCE (2002) Minimum Standards, pp40-41

Key: C for compulsory and E for elective. Students are expected to pass a minimum of 36 credit units compulsory and four electives before graduation and certification.

Table I appropriately has shown the curriculum components of the NCE computer science. As good as it may have been, it may seemingly be necessary to consider an adaptive dimension of a curriculum component. This becomes necessary because technological development is becoming quiet dynamic. The adaptation of instruction to meet learner needs is an expectation inherent in the goals of education and is an essential ingredient of any consideration of instruction approaches. Adaptive Dimension is a component of core curriculum and instruction.

The Adaptive Dimension is defined as the concept of making adjustments in approved educational programmes to accommodate diversity in students learning. It includes those practices the teacher undertakes to make curriculum instructions and the learning environment meaningful and appropriate for each student.

The essence of the Adaptive Dimension rests in the phrase “seeking other ways”. This offers students alternative access to an expression of knowledge that facilitates their participation in learning. Specifically, the Adaptive Dimension is used to:

- ❖ Maximize student independence.
- **Maximize generalization and transfer.
- ❖ Lesson discrepancies between achievement and ability.
- ❖ Promote a positive self-image and feeling of belonging.
- ◆ Promote confidence.
- ❖ Promote a willingness to become involved in learning.
- ❖ Facilitate integration.

One could see that these variables address a primary function of the school -that of helping students to maximize their potentials as independent learners. The adaptation required may therefore, vary from presenting the same content through a slight different instructional method, modifying the content because of a known information background deficit, or to establishing an individual or small group enrichment activity. The duration of adaptation may range from five minutes of individual assistance to providing opportunities for some students to expand their knowledge and extend their understanding by working independently. The consequences of the foregoing are that certain issues will necessarily have to be addressed.

Emergent Issues

Now it becomes crystally clear that there are certain emergent issues to address, if Nigeria intends to be firmly grounded and to some extent technologically self-reliant. Some of such issues include:

Professional Development of Teachers

It becomes very obvious and important that professional development be made available to Teachers of technology. This is based on the fact that no individual can give what he/she do not have. Moreover, no nation can rise above the educational standard of her teachers (Federal Ministry of Education, 1998). It is important to provide adequate training for the teachers, as this will help them to be abreast with and choose the most appropriate technologies. Students cannot be expected to benefit technologically if teachers are neither familiar nor comfortable with it. Teacher needs to be supported in their efforts to use technology. The primary reason why teachers do not use technology in their classroom is the lack of experience. Terrette (1994) found that teachers who had received professional development with computers are more likely to use computers effectively than those who had not participated in such training.

Teachers must be trained in the use of computers. This means that their training must go beyond the instructional strategies needed to infuse technological skills into the training process. It should specially focus on practical application of technology. Note that teachers cannot be expected to know how to use computer in their teaching after a one- time workshop. Teachers therefore, need in - depth, sustained assistance not only in the use of technology but also in their efforts to integrate technology into the curriculum. According to Terrette (1994), teachers have always been the key to determine the impact of innovation and this situation is true of technology.

Apart from pedagogical support to help students use technology to reach learning goals, teachers need time to become familiar with available products, software and on-line resources. They also need time to discuss technology use with other teachers. There arise the need here for professional collaboration with other educators in similar situations and others who have experience with technology.

Availability of Facilities

The NCCE (2002) is very much a life on the central occupation of facilities as a sine qua non to achieving effective technological break through. It therefore, stated that certain essential facilities , must be provided as a minimum condition. Some of which include:

- 1 Computer laboratory for the use of computer science department only. This must be air-conditioned.
- Z 1 Computer center for training / teaching of other students / commercial purpose which must be air-conditioned.
- Z Regular supply of software material.
- Z I Multimedia system.
- Z Microcomputers of ratio 1:5 and other peripheral equipment.
- Z Standby power.

Although, these things are mentioned and recommended by the NCCE, the truth of the matter is that they are not there on ground. If these facilities are lacking or near lack in the institutions that are expected to produce those who will teach in our public and private primary and secondary schools, your guess is as good as mine on what will be fell the nation's technological quest. You could also imagine the caliber of people that will be turned out. The nation may end up producing technological mediocre which will cost her more than investing adequately in the provision of these facilities. Though one may argue that such campaign as e-Nigeria by Nigeria Information Technology Development Agency (NITDA), individuals or organizations such as Zinox are trying by offering some helping hands to institutions. This actually is not enough. It is just a tip on an iceberg. Governments, individuals, organizations, companies and professional bodies are encouraged to do more than they are currently doing.

Monitoring and Evaluation

The supervisory body (NCCE), of all NCE awarding institutions has done well by making available the minimum standard. It should not stop there; it must further strengthen her monitoring unit. If this is sincerely done, these institutions will perform their role. It may have positive effect on their products (students), and the society finally will be better for it. To ascertain this, evaluation becomes necessary. Evaluation generally focuses on how well the final product meets the original and

Information and Communication Technology (ICT) in Human Resource Development: Issues in Nigeria Certificate Education (NCE) Computer Science Curriculum

required task. It should as well consider the process of how well students carried out the information problem-solving process (efficiency). The evaluative issue must necessarily consider whether students:

- o Abide by telecomputing etiquette when using e-mail, newsgroups, list serve and other Internet functions.
- o Understand and abide by acceptable polices in relation to the use of Internet and other electronic technologies.
- o Use desktop conferencing and groupware software on local area networks to communicate with teachers and others regarding their performances on assignments, tasks, and information problems.
- o Operate various pieces of hardware and software- particularly operating system - and be able to handle basic maintenance.
- o Understand and articulate the relationship and impact of information technology on careers, society, culture and their own lives.

All these should form the focus of evaluative process since they are cardinal to human capacity development. An individual that measures up to the issues considered above may be deemed useful technologically and could contribute to its development in the society.

Recommendations

Consequent upon the foregoing discussion the following recommendations are made:

- Teachers' professional development should have certain levels of flexibility and responsive development. They should be given both short and long-term training.
- In terms of facilities, very negligible schools are supplied with proper machines and tools. In this regard, teachers should liaise with experts, organizations, NGo^s professional bodies such as NCS for adequate help and advice regarding their selection and purchase. The computer laboratories should be adequately supplied with computers, appropriate hardware, software, and other peripherals.
- Schools should establish a realistic time frame for improving students' achievement through technology. All stakeholders should be sensitized to recognize that new skills, new technologies, new curricula, and new practices all take time to be come effective part of teachers' and students' daily routines.
- The computer science curriculum should be more adaptive in nature because of the dynamic nature of ICT.

Conclusion

It is at this point clear that human capacity development is not only relevant at the tertiary levels but could begin right from the very foundation of our educational system. This paper therefore, considered human resource development. Attention was given to NCE computer science curriculum since the NCE graduates are usually saddled with the responsibility of teaching at the primary and junior secondary schools. On these ground issues such as teachers' professional development, making facilitates available to schools/colleges as well as adequate monitoring and evaluations of the curriculum were raised. Some recommendations were made and conclusion reached.

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