A Review on Career Opportunities in Computer Science/Information and Communication Technology (ICT) Education

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Abstract

Acquiring required skills in Computer Science/ICT education is very crucial in this information age. Almost every discipline requires services of computer science /ICT specialists as a result of its application to many facets of human endeavours. Thus, this paper reviewed career opportunities in Computer Science / ICT education and the impact of ICT on poverty. It x-rayed reasons for choosing or selecting a career or profession. The paper also looked into ICT Education, Youth Employment and Development. The paper proffered recommendations, such as, provision of loan facilities to computer /ICT graduates at all levels of education that possess adequate and entrepreneur skills in order to invest in Computer Science / ICT discipline, the need to review Computer Science / ICT education curriculum at all levels of education so as to incorporate new knowledge area in the discipline, amongst other.

Keywords: *Career, Opportunity, Computer science education, ICT education, Job security*

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Background to the Study

The acquisition of adequate entrepreneurship skills in Computer Science as a course of study in Nigerian tertiary institutions can effectively provide job or career opportunities to the teaming youths. If Computer Science/Information and Communication Technology (ICT) education is taught adequately, there are quite numbers of job opportunities that await the graduands. The mission statement of Federal Republic of Nigeria – FRN (2001) clearly pinpointed that Information Technology which is integral part of Computer Science should be used for "Education, Creation of wealth, Poverty eradication, Job creation and Global competitiveness". Therefore, if the right peg is put in right hole, there is no mistake in tailoring Computer Science curriculum towards entrepreneur skills, so as to achieve the spelt out mission statement.

Computer Science / ICT education entails the design and the use of Computer peripherals or devices, such as software and hardware. Here, the software includes all system and application programs that will enable computer to perform its laid-down objectives, such as, word processing packages, spreadsheet programs, graphic programs, operating system, device drivers, antivirus, programming languages, to mention but a few. Hardware includes all ICT tools that work effectively with software, such as personal computers, monitors, keyboards, mouse, mobile phones, CD/DVD–ROM, and so on. Computer Science is taught in schools to enable students have required skills that will enable them be self-reliant in the society by choosing a career in the field and become professional.

Career is referred to as a job or occupation regarded as a long-term or lifelong activity (Microsoft Encarta, 2009). British Broadcasting Corporation – BBC (1992) puts the definition of career as a type of job or profession that someone does for a long period of his life and in which he / she hopes to gain advancement. Opportunity is a chance, especially one that offers some kind of advantage. (Microsoft Encarta, 2009). Thus, career opportunities can be described as chances or advantages of getting job or occupation for long-life activity after graduating from a course of study which the graduand hopes for advancement on the job.

Theoretical Framework

This paper is based on Holland's Theory of Vocation. The theory by Holland offers a simple and easy to understand framework on career interest and environments that could be used in career counselling and guidance. Holland postulated that vocational interest is an expression of one's personality, and that vocational interests could be conceptualized into six classifications, which are Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C). The theory was postulated in 1985 (Leun, n.d.). This theory is relevant to this study because all the six typologies postulated by Holland are in line with skills and career development in Computer Science or ICT Education. These typologies are further described, according to (Anonymous, n.d.) as follows:

1. **Realistic** – Career is all about working with hands, machines, tools, active, practical and adventurous. Computer Science / ICT is one of such fields that realistic can be applied.

2. **Investigative** – Career development is through thoughtful thinking, analytical approaches, explore, knowledge and ideas. Career in Computer Science / ICT involves all these technical-know-how techniques.
3. **Artistic** – literary, musical, artistic activities, emotional, creative and open. Working with Computer system / ICT devices requires one to be skillful and creative.
4. **Social** – train, inform, educate, help, supportive, avoid technical skills, empathy and relationships. There is need to be more informed, educated and trained while working with Computer system or ICT tools.
5. **Enterprising** – verbally skilled, persuasive, direct, leader and dominant. Computing or ICT field is really enterprising.
6. **Conventional** – rules and routines, provide order or direct structure, great self control, respect power and status, punctual and orderly. In order to achieve desired objectives while working with computer or ICT, all these must be fulfilled.

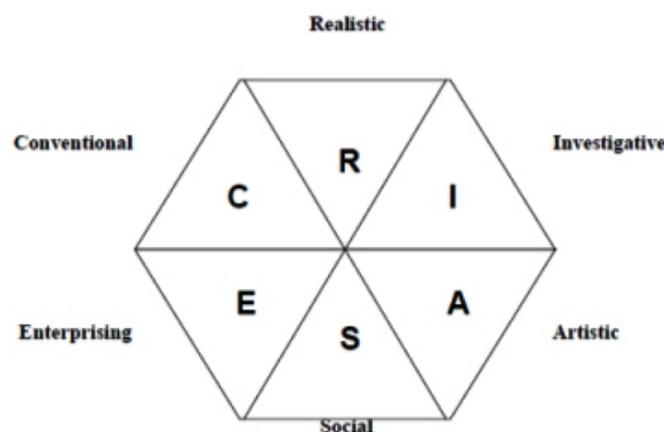These six topologies can be represented diagrammatically as indicated in figure 4 below:

Figure 1: Illustration of Holland's Six Topologies of Vocation. Source: Anonymous (n.d.)

The Concept of ICT and Poverty
Poverty among many citizenries is the greatest challenge facing Nigeria and a recent scale has shown that unemployment, income inequality, polygamy, business failure, sickness and environmental degradation are among the main causes of poverty in Nigeria and sustainable poverty eradication is unlikely to be achieved without the proper use of ICT (Okwuonu, 2010). It has been widely established that the technical–know–how in Computer Science or ICT education can greatly reduce the nation's poverty level. For instance, Okwuonu (2010) reported that ICT has helped greatly to improve the lot of people across the world. He further stressed that in Nigeria, thousands of youths have been pulled out of poverty due to the usefulness of ICT. It plays a major role in all aspects of national life: in politics, in economic life, as well as in social and cultural development. It is rapidly transforming our lives, the way we do business, access information and services, communicate and entertain each other. It fuels the global economy. ICT plays major roles in alleviating poverty in different ways,

especially in the lives of youths whose hopes were almost shattered upon finishing schools and not finding jobs. Jimoh and Oladimeji (2012) observed that ICT can assist in poverty reduction and youth empowerment.

In the words of Ndukwe (2007), to herald the next phase of the nation's ICT evolution, emphasis shall have to be placed on an "ICT for Economic Growth Policy." Such a policy instrument must be able to foster the improvement of the following key elements, such as, creation of hundreds of thousands of new ICT-related jobs, new employment opportunities in software and network engineering, and cascading effect of income earned in newly created ICT-related jobs.

However, Oye (2012) opined that ICT, as a sector, can create some employment opportunities directly to the poor both in the manufacturing of hardware and software. Because of the low educational levels and skill of the poor, we can expect that there are more employment opportunities in the service sector.

Figure 2 below illustrates the requirements to achieve the concept listed i.e. to make ICT effective as an anti-poverty tool.
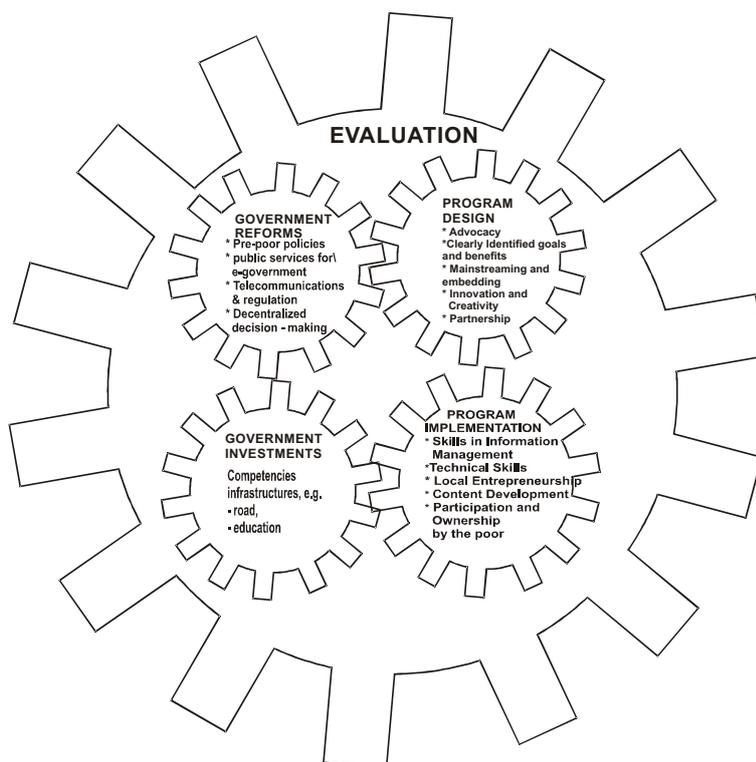

Figure 2: Illustration of the requirements to make ICTs effective as an anti-poverty tool.
Source: Adapted from Yekini; Rufai; Adetoba; Akinwole and Ojo (2012)

Relationship between Society, ICT and Poverty

Society exists and it was created by God Almighty. Poverty is natural phenol-menon that exists in the society. No matter how God bless a particular society, one cannot rule out poverty completely, but it can only be minimized or reduced using the endowed available resources. Thus, poverty is embedded in a society. With the emer-gence of ICT tools, it has come to pave ways for means of wealth creation, job opport-unities and thereby reducing the rate of poverty and unemployment in the society. To imagine the impact of the influx of ICT, different job opportunities emerge and inhabitants of the society get means of their daily bread which does not exist before when we look back as far as year 2003 downward. Figure 2 depicted relationship between three components: Society, ICT and poverty.
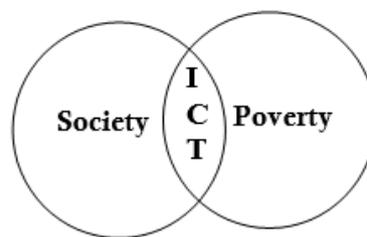

Figure 3: Interaction between Society, ICT and Poverty.
Source: Adapted from Jimoh; Kazeem and Folorunso (2013)

ICT Education, Youth Employment and Development

This section x-rays Digital Divide Data (DDD) programs. According to the report of United Nations Educational and Scientific Cultural Organization – UNESCO (2013), a selection of young high school graduates from rural areas in Cambodia were sampled and joined the DDD programme for 3-8 months and undergone thorough ICT training in order to develop basic ICT competencies as well as English skills. After the completion of the programme, trainees must meet the DDD standards to be offered an employment with DDD.

The standards required, according to DDD Annual Report (2012) as cited in UNESCO (2013), are basic computer skills, proficiency in English, ability to type quickly and accurately, and have basic workplace skills. Successful trainees were invited to work as data management operators in the DDD work/study programme where they can gain "on-the-job" work experience and further develop their skills. As part of the programme, they were supported to work half-day and pursue university degrees at the same time. They earned incomes that enabled them to support themselves and help their families. After a three month probation period, they were eligible to receive a scholarship package to support their higher education that includes a scholarship grant, contrib.-ution from their own earnings, and in some cases, a loan. Typically, they take about 3-4 years to earn their degrees, and in the meantime receive further training and workshops in management, career manage-ment or English (DDD Impact, 2013) as cited in UNESCO (2013).

From the scenario narrated above, Nigerian government can emulate such programme for the citizenries using National Directorate of Employment (NDE) as an agency for the training and absorb the participants after the training having met the required standards. This will enable such participants to get their daily earnings while pursuing their higher education programme. Thus, copying and executing this programme will go along line in empowering and developing youths using ICT education as a tool. Figure 3 below represents different roles of ICT in the youth empowerment and development.
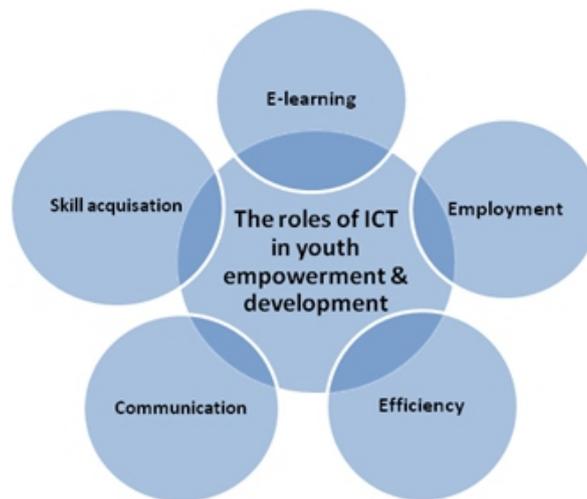

Figure 4: The Roles of ICT in the Youth Empowerment and Development.

Conceptual Framework
The conceptual framework of this study is based on IPO; input, process and Output. Inputs in this case are Computer Science / ICT up-to-date curriculum, well-qualified personnel, Conducive learning environment, equipped ICT/Computer Science Library and Laboratory. The process on the other hand is the learning activities that take place between teachers and students, while the output is production of well-grounded graduates that can be self-reliant in the field of ICT/ Computer Science to develop the society. Figure 5 below is the linkages of all these variables.
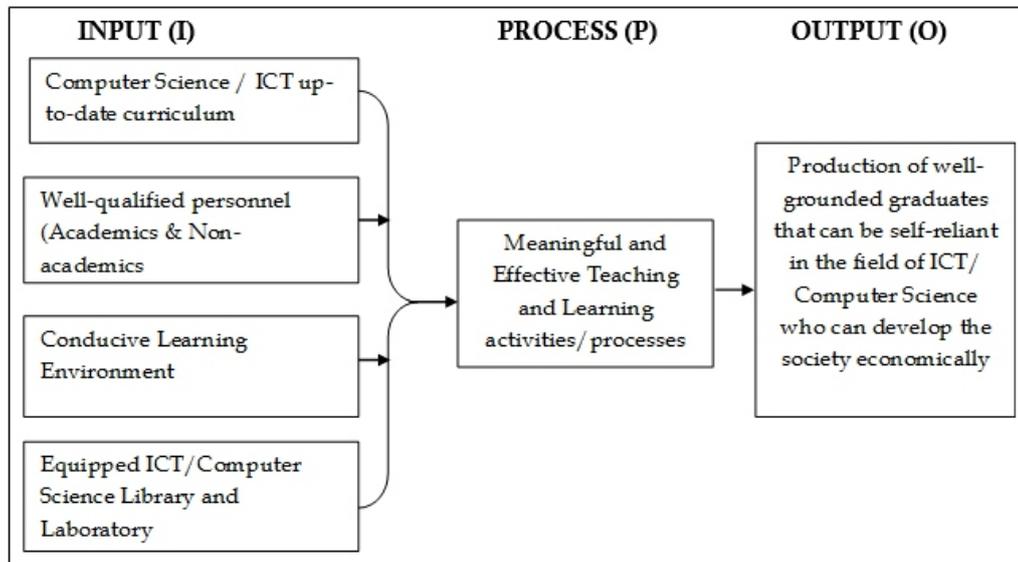
Figure 5: IPO Structure of Conceptual Framework

Career Aspirations

There are several factors that surround aspiring and choosing a career by an individual. Choosing or aspiring for a career can be due to job security, well-paid salary package, prestige associated with the profession, potential to establish by oneself in absence of white collar job. Gogwim (2008) identified four key factors that determine someone's aspiration for a career or profession as follows:

1. Job security,
2. Job satisfaction and confidence,
3. The chance to good money
4. Plenty of varieties opportunities

Therefore, there is need for one to study meticulously all these factors before choosing a course of study in any institution. However, Denis (2010) opined that there are few reasons for choosing ICT field as profession; good job opportunities, demand across the world, high economic benefits, different development career paths and travelling opportunities to other countries of the world.

Career opportunities in Computer Science /ICT Education

There are many career opportunities in ICT / Computer Science Education. International Telecommunication Union – ITU (n.d.) comments on the nature of career opportunities in ICT/ Computer Science Education that the ICT sector remains a buoyant and growing sector for employ-ment and a key sector underpinning both national and international development. Employment in the ICT sector has continued to grow significantly in recent years. According to the Northwest Territories (2006), the growth of ICT has changed the way we live, work and do business. It has created a large, rapidly growing demand for people who can install, operate and maintain hardware (equipment) and networks as well as applications or software that run

them. The ICT industry is growing and offers exciting career opportunities to suit many interests and backgrounds. There are many new opportunities for trained people being created everyday in the growing ICT sector across the world.. There is also room for advancement in the field as well.

Some of the career opportunities in ICT/Computer Science education, according to Heathcote (2000), Government of Northwest Territories (2006) and Denis (2010) are as follows:

1. Software Engineering,
2. Network Engineering,
3. System Engineering,
4. Database administration,
5. Client management,
6. Web Development,
7. Quality Assurance and Testing,
8. Technical Support,
9. Information Technology Consultancy,
10. System Security,
11. Project Management,
12. Software Development,
13. Hardware and Software Teaching

This implies that a graduate in Computer Science or Information and Communication Technology (ICT) can choose one or more of these professions to practice, and thereby making daily earnings, thus are self-employed.

Similarly, in a research conducted by Jimoh, Kazeem and Folorunso (2013) titled "the impact of ICT on poverty reduction in Azare Community, Katagum Local Government Area of Bauchi State". It was discovered that there were many ICT related job which many citizens do make their daily earnings. Table 1 below depicts the available ICT-related jobs and number of available centre with the total capacity staff strength in each of the centres.

Table 1: ICT related jobs in Azare Community, Katagum Local Government, Bauchi State

S/N	Description of ICT related jobs	No. of available centre	No. of employed staff
1.	Internet Café	2	12
2.	Computer Business Centre	26	62
3.	Computer Training Institute	21	53
4.	Computer Maintenance & Repairs	6	23
5.	Mobile phone maintenance & Repairs centre	15	36
	Recharge card business centre	65	107
7.	Mobile phones sellers centre	22	52
8.	DVD, TV, Radio, Tape -recorder, etc repair	27	68
	Total	**184**	**413**

Source: Jimoh, Kazeem and Folorunso (2013)

The table 1 above indicated that as at the time of reporting, eight different ICT-related jobs were operating with 184 centres and 413 staff working strength. It can be seen that ICT can effectively provide job opportunities to teeming youths if there are adequate programs.

Challenges to the Computer Science / ICT Education
Many challenges are militating against the effective study of Computer Science/Information Technology as a course in Nigerian Institutions. These among others are inadequate curriculum design, infrastructures, funding, technical-know-how on the part of manpower employed, to mention, but a few.

Curriculum review challenge: Computer Science/ICT education curriculum needs to be reviewed from time to time so as to incorporate new knowledge area in the field. Computer Science / ICT education is a course that changes momentarily every month with new cutting-edge technology devices. Therefore, the curriculum develop-ment committee at all levels of education (university, polytechnic, college of education, etc) should bear these changes in mind so that up-to-date technical-know-how can be imparted into learners who will be in turn using the knowledge acquired in the society after the graduation. Christian (2009) commented on the nature of curri-culum in Nigerian institution, that:

> *To say that the current computer science education curriculum in Nigerian tertiary institutions of learning is obsolete is an understatement. With the dawn of the Information and Communication Techn-ology (ICT) revolution, Computer Science education was introduced not only as a full degree/ diploma and certificate programmes in Nigerian universities, polytechnics and colleges of education, as well as at other levels of the Nigeria education system, but it has also been made a mandatory requirement for every Nigerian university graduate at least at the appreciation level, so as to produce graduates that can fit into the workplace and be competitive in the dynamic, fast-paced global information economy. The move as brilliant as it is was based on an academic framework that is not only outdated but counterproductive, as it led to the production of graduates of poor quality that can*

not fit into the marketplace, let alone competing with their counterparts from other parts of the world. The reason for this is not far-fetched. Apart from non periodic review of the curriculum to meet changing requirements of the time, the teaching facilities (laboratories, libraries, PCs, software, books et cetera), teaching methodology and available expertise were not only inadequate but below standards as obtained in advanced countries.

Critical observation of the above viewpoint, it can be seen that our syllabi in all levels of education should be re-directed towards practical oriented approach rather than bookish form and should be reviewed in consonance with the new knowledge. This will assist graduate in computer science /ICT discipline to be self-reliant and useful after the graduation.

To buttress the above point, Agbo (2004) observed that the curricular of all levels of education were purely academics and unrelated to the world of work, merely encouraging the acquisition of paper qualifications. Thus, if meaningful education is to be imparted into learners, Nigerian educational planners should re-direct the curriculum towards practical or entrepreneurial skills. Though, entrepreneurial skill as it is recognized by the government, a course of study in form of general studies has been introduced into all levels of education, this alone is enough to equip one to be self–employed or self-reliant after graduation.

Infrastructures
This is another major challenge to Computer Science / ICT education in Nigerian institutions. Infra-structure includes power supply, laboratory equipped with latest technology and internet facilities, alternative power supply in case of power failure (standby generator), etc. Okolo (2005) observed that among the challenges to ICT training is the limited ICT infrastructures in the schools. Therefore, improved telecommunications and Internet connectivity is an important determinant of success if ICTs are to reach every school. Unavailability of infrastructure has hindered the acquisition of required skills by students through their teachers in schools. For instance, it is impossible for teachers to teach effectively the use of Internet as course of study, while the computer laboratory is not connected to Internet facilities. The teacher will end up describing the course theoretically where there is not equipped laboratory.

Inadequate Funding and Manpower Challenges
Funding has been a major challenge to development of education in Nigeria generally. In the word of Yaki (2005), adequate and sustained funding is the backbone of any successful national programme and Computer Science Education programme is not exempted. However, Akintola, Aderounmu & Owolarafe (2002), Mushelia & Msheliza (2010) observed: poor funding; inadequate equipment/infrastructures; students' popu-lation explosion (without commensurate facilities); lack of high-quality manpower (in terms of trainers or teachers); inadequate industrial training; and poor attitude of employers as the dominant problems faced by engineering, vocational and technical education in Nigeria.

Summarily, Egwu (2009) and Opara (2009) identified the following as challenges to ICT at the Post-Basic Education level:

1. Lack of requisite ICT infrastructure and instructional materials, institutional weaknesses such as dearth of qualified ICT teachers and other IT personnel, low capacity of
2. ICT teachers as well as poor regulation of IT education leading to a proliferation of quacks. Lack of commitment by schools to the delivery of Computer Education.
3. Low appreciation of ICT on the part of education administrators.
4. Phobia for use of computers, on the part of teachers, resulting in poor utilization of existing facilities.
5. Problems of power and energy.

Conclusion

Acquiring an excellent skill in Computer Science/ICT education is very important in this information age era. Almost all fields of human endeavours require the use of computer or ICT peripherals. With adequate knowledge in this discipline, it gives an ample opportunity to secure job with any other organization that requires computer specialists. This paper has looked into career opportunities that are available in Computer Science /ICT. Therefore, with financial backing, graduates of the discipline can invest on it to earn daily living.

Recommendations

The following recommendations are proffered to encourage computer science / ICT graduates invest in the discipline and encourage citizens to study the course so as to enable them to earn a living:

1. Federal government should create loan facilities to computer /ICT graduates at all levels of education that possess adequate and entrepre-neur skills to choose a career in computer / ICT discipline.
2. Curriculum of Computer Science / ICT education should be reviewed from time to time to accommodate new changes in the curriculum.
3. Students should be encouraged to run a professional course, such as, Oracle Database, Cisco Network Certification, Microsoft Certifica-tion, etc after their graduation so that they can have added advantage while applying to multinational organization.
4. Government at all levels should fund education, especially on the ICT infrastructure, etc.
5. Qualified technical-know-how man-power should be employed in our various institutions.
6. Skill acquisition centres established by Federal Government should be monitored properly to its full implementation.
7. ICT or Computer studies education which has been introduced at Nigerian secondary schools should be properly monitored and funded to see that young school-leavers have adequate computer know-ledge.

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