Application Of Information And Communication Technology (ICT) To Implementation Of Chemistry Education Programmes In Nigeria School System

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Abstract
Information and communication technology (ICT) is the process of utilizing information and data dissemination through electronic facilities such as computers, videos, radios and phones. Chemistry is a science discipline that forms a bedrock of many technologies and yet is much dreaded by learners because of the methods the teachers adopted in teaching the concepts. This paper therefore theoretically explored the status of application of ICT devices in Nigeria education system especially in chemistry teaching learning process. Some likely chemistry learning strategies and corresponding ICT devices applicable were highlighted. The problems hindering full application of ICT devices in chemistry learning like lack of fund, ICT devices, unpatriotic citizens, lack of trained manpower were highlighted. Suggestions for improvement were proffered.

Introduction

Effective education in science disciplines especially in Chemistry can be achieved through proper teaching and learning with adequate relevant and effective instructional materials such as the information and communication technology (ICT) devices (Jongur, Mahammed and Abba 2008). The ever increasing decline in enrolment and achievement in chemistry and physics (WAEC Chief Examiner's report 2000-2005) points to the fact that there are increasing conditions for under achievement and slow learning portraying possible failure of previous efforts of science educators in improving the learning situation. In reality, these previous efforts of Nigerian science educators did not skew in favour of usage of ICT devices for improving science learning situation for obvious reasons which will be seen in the text.

In line with the above, Adelaja (2007) stated that, the latest World Economic Forum on Global Information Technology (WEFGIT) report revealed that, Nigeria is 10th in the development and application of information technology in Africa, and 88th in the world. He added that the new ICT related devices can make institutions more productive, enhance skills and learning. Even though this awareness has been created, there still exists insurmountable barriers to immediate full and successful implementation in the education system. However, since the journey of a mile starts with a step, there is hope that eventually, the dreams would be actualized.

ICT Education

The 21st century has reduced the universe and its contents into a small sphere popularly named global village. This has therefore evolved an era of global computations. Again, it has resulted in a shift from standing alone information dissemination to network distribution of information (Agbo and Abu, 2009). These are offshoots of adoption of information and communication technology which allows dissemination of information to anybody, anywhere and anytime.

According to Anthony, Saidu, Mohammed and Junguru (2009), ICT education is the education acquired through computers and other electronic media. ICT devices are being harnessed to improve the efficiency, accessibility and quality of the learning process in developing countries. One of the most commonly demonstrated applications is distance education (or e-learning). Ezekoye (2005) stated that the development of e-learning products and the provision of e-learning opportunities is one of the most rapidly expanding areas of education and training. Whether this is through an intranet, internet, multimedia, interactive TV or computer based training, the growth of e-learning is accelerating. That was why Rosenberg (2001) stated that the core criteria for something to be e-learning is that it is internet based, networked and focuses on a much broader view of learning and knowledge delivery than traditional training and learning methods. It provides visual classroom that allows the tutor to present materials to any number of people at the same time and also chat rooms to enable a learner to invite another learner logged into the system to engage in synchronous discussion. It has back-end data base to handle all the learning materials and administrative data. In addition, evaluation is an essential element in the design and planning of any e-learning programme or innovative process. It ought to span the whole life cycle of the programme embracing both formative and summative aspects of the e-learning.

Chemistry and the Learners

Chemistry education directly or indirectly plays an essential role in attempting to tackle the major human and socio-economic problems in addition to making the society more scientifically literate. This statement is reaffirmed by the notion that chemistry is a requirement for studying such courses as medicine, pharmacy, and engineering among other courses. Infact, the Nigerian University Matriculation Examination (UME) requires a pass at credit level in Chemistry at

Senior Secondary School Certificate Examination (SSCE) as minimum requirement for registering for those vital courses.

Yet, many students fear and shy away from it as a monstrous discipline. Ezeliora (2009) stated that the reason why chemistry is perceived as difficult and abstract is the way it is being presented to students. As a matter of fact, it will be good to see chemistry as a multifaced/multifaceted subject/discipline. Some aspects are abstract, others highly computational, some are practical/hands-on and soon. All these aspects are encountered as physical, inorganic, organic, and analytical chemistry. Topics like radio-and nuclear chemistry, electrochemistry, wave – particle duality of matter among others can be made less abstract and more interesting to learners by the method adopted by the teacher. One such method is application of information and communication technology (ICT) devices in the teaching and learning of chemistry.

The topic could be presented as packages for programmed learning and displayed on screens. Children are interested in watching cartoons displayed on televisions. Displaying topics like nuclear fission chain reaction, wave particle picture of matter, macro-molecules among others will present an interesting and captivating lesson to learners. This will also approximate to contextual situation and reduce the perception of chemistry as being merely a body of isolated facts to be memorized, lacking relevance to reality.

Chemistry requires hands-on and minds-on activities. Since it is a multifaced subject, not every face can be handled as hands-on activity. It then follows that minds-on and eyes-on application of ICT devices can act as a welcome departure from routine. Learning chemistry is something students do, not something that is done to them (NRC 1996). The teaching and learning of practical aspect such as titration, saponification, electrolysis among others could be done using ICT facilities as will be discussed in later subheadings under learning strategies.

ICT and Chemistry Education

The Chemistry education sector is an integral part of scientific and technological sector of any nation. Hence this sector plays a key role in the well being of the nation. A weak chemistry education sector not only jeopardizes the long-term sustainability of any socio-economic system but can also lead to crises in national development. Therefore, attempts should be made to explore ways of stabilizing and improving the methods of delivery of the lessons to the learners within or outside the formal school settings. One such method is adoption of learning strategies involving ICT devices in chemistry lessons.

The rapid advancement in information and communication technology (ICT) has had a profound impact on the education sector and other spheres of life. It has become a tool that facilitates education organizational structures, strategies, services

and other related functions. Furthermore, technological innovation has brought about the speedy processing and transmission of information, easy marketing of education products, enhancement of learner access and awareness, wider networking in addition to regional and global links (Maduchie, 2008). The development in ICT has enabled education system to provide more diversified and convenient educational services, even without adding physical structures. The development of internet services, which is an extensive, low-cost and convenient education network, has facilitated educational services to learners anywhere and anytime. Along with internet and web-based services, a need for changing core education architecture has emerged. The introduction of virtual/digital libraries by some institutions and communities, added to their links with the improved telecommunication network has enabled lesson delivery to be done on-line, in contract to the normal classroom./laboratory batch- processing modes conventionally adopted. The integration of e-learning with internet learning and education websites is also a notable feature. These ICT advancements have enabled developed nations/institutions to gradually replace the conventional practices by automated procedures with on-line real time processing. That was why Mankiliki and Agbo (2006) acknowledged the importance of ICT as opportunity to revolutionize teaching methods and educational management. They however lamented that traditional pattern of teacher education has remained largely unchanged in Nigeria. This is because, Nigeria is not a developed nation and hence lacks ICT devices.

Research has also shown that students learn more meaningfully when they work in small cooperative chemistry groups (Nwachukwu 2006) and have the opportunity to negotiate meaning and construct conceptual understanding in a community of learners thereby making chemistry learning more relevant. In line with the above, Jajua (2006) stated that one of the recent drives of the society towards making education relevant is making information and communication technology (ICT) a common feature of the educational processes. Typical electronic facilities include computers, videos, radios and phones. These gadgets facilitate learning and enhance individualized learning.

Again, Kwache (2007) was of the view that in concrete terms ICT enhances teaching and learning through its dynamic interactive, flexible and engaging content. It provides real opportunity for individualized instruction, accelerates, enriches and deepens skills, and engages students' activity in learning. Also Zandvliet, David, Fraser and Barry (2005) investigated the typical activities taking place in the computerized classroom environment. The findings revealed a high level of students' involvement in other activities besides learning. It showed that students spent most of their time interacting directly with the computer. Browsing on-screen and entering data together accounted for nearly fifty percent of the total time spent in class. It also revealed that the computerized learning environment fosters independent study and limited teacher dominance in lesson control and learning processes. Some learning strategies and ICT application form the next subheading.

Some Chemistry Learning Strategies and Application of ICT

Jongur, Mohammed and Abba (2008) identified the following learning strategies and ICT facilities applicable for their success.

- Cooperative learning and small group activities
- Individualized activities
- Immediate feedback
- Critical thinking motivator.

The ICT facilities applicable to cooperative learning are use of e-portal, video clips, and interactive radio programmes. Students are grouped and learning materials structured in such a way that they are interactive and participatory as much as possible to help each member of the group to learn.

For individualized instruction in science learning ICT facilities include LCD projector, overhead transparencies, video clips, computers and radio sets. The learning material is structured in such a way that it can facilitate individual learning.

For Immediate Feedback in science learning, ICT facilities applicable are: projector, overhead transparencies, video clips, computer slides/power point facility, and projector screens using transparencies etc. The teacher stops at appropriate point to give quick tests of the materials. This enables him/her to either modify or continue or re-teach any particular concepts.

In the case of critical thinking motivation, the ICT facilities applicable include video conference, E-mail/Fax, and phones. This method attempts to get students involved in discussion of or thinking about learning materials either before any theory is presented in lecture or after several conflicting theories have been presented. The idea in the first case is to generate data or questions prior to mapping out the theoretical landscape of the concept. The idea in the second case is the that students learn to assess the relative merit of several approaches used in teaching such concepts.

The assertion that 'application of ICT in Nigeria education system is negligible' is not an exaggeration. This is observable in the issues to be addressed in the next subheading.

Issues and Challenges

Problems and challenges of application of ICT devices in teaching – learning process in Nigeria hinge around a number of factors. They include non-availability of fund, materials, among others. These can be further described as problems of acquisition and/ or supply of ICT instructional materials and equipments, irresponsible and lip-service attitudes of government and the general society towards chemistry education in particular and science education in general, problems arising from the technical and abstract nature of chemistry teaching – learning concepts,

epileptic power supply, inadequate financing of science/technology education, shortage of teachers in quality and quantity, inadequate textbooks, insufficient time in the school timetable due to other competing subjects as well as family background and gender issues. The governing powers and Nigerians in general are full of self-centered individuals living in self-imprisonment, and, enclaved in acquisitive tendencies. Most Nigerians are unpatriotic and therefore do not give priority attention to ideas/programmes that will benefit the masses. There is very insignificant continuity in proposals and projects from one governing regime to another. Every regime mounts its own project and abandons the uncompleted project from the predecessor and this ends up as wasted resources.

Conclusion

This paper is concluded by pointing out that even though the country is aware of the usefulness of ICT devices in education system, the adoption is still generally insignificant and negligible in the general education of the masses. Lack of fund, insufficient trained manpower, insufficient ICT facilities and devices seem to contribute to the short comings in the adoption. However, suggestions for ameliorating the situations are proffered in the next subheading.

Way Forward/Suggestions for Improvement

a. Training of Teachers/Educators/Facilitators: There is need to adequately and urgently train the above manpower in sufficient number for the various ICT programmes using the available devices.
b. Training of Maintenance/Servicing Technicians, operators, Technologists and Engineers: The above personnel should be trained in quality and quantity to enhance smooth and continuity of the operation of the devices, otherwise the lifespan will be short like most ventures in Nigeria.
c. There should be continuity of training/retraining of all these manpower otherwise the adoption of ICT gadgets in Nigerian education system will end up a mirage.
d. The problem of electricity supply should be properly put under control.
e. Philanthropists should be mobilized to aid in the funding of the purchase of ICT devices and infrastructure since the government along cannot do it.
f. There should be continuity in execution of projects from one regime to another.
g. Nigerians should be liberated from self-imprisonment so as to be patriotic.
h. ICT devices should be mounted in communities for grassroots involvement, and awareness campaign should be mounted.

There is hope that adequate implementation of the above suggestions will enhance the use of ICT devices in teaching and learning of Chemistry and other sciences thereby eradicating major socio-economic problems of the nation.

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