ICT AS AN INNOVATIONAL CATALYST FOR TEACHING METALWORK TECHNOLOGY

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Abstract
Enhancing the quality of education through the diversification of contents, methods and promoting experimentation, innovation, dissemination, sharing of information and best practices as well as policy dialogue are strategic objective in education. The objectives of the review are to determine the role of ICT in teaching metalwork technology and to suggest modern approach such as Blended Learning model in teaching the subject. The review also examined the urgent need for a modern school workshop that comprises Computer-Aided Instruction (CAI), Computer-Aided Design (CAD), and Computer-Aided Manufacturing (CAM) that should enhanced teaching and learning process in metalwork technology. Consequently, the paper outlined some of the challenges facing metalwork teacher. It was recommended that training and re-training of technical teachers should be encourage by the colleges, particularly in ICT and Blended Learning as well as interactive teaching methods, networks and the sharing of best practices among the academic staff.

Keywords: skill acquisition, ICT, blended learning

Introduction

Improving the quality of education through the diversification of contents and methods; promoting experimentation; innovation, the diffusion and sharing of information and best practices as well as policy dialogue are United Nation Educational, Scientific and Cultural Organization's (UNESCO) strategic objective in education (UNESCO, 2002). ICT have become key tools and had a revolutionary impact of how to see the world and how to live in it. However, Metalwork technology education is one of the core subjects in technical and vocational education in Nigeria that needs ICT as catalyst for successful teaching of the subject. The main concern of the programme is skills acquisition such as welding and fabrication, fitting and machining, milling, grinding, turning, shaping, screw cutting, riveting to mention but a few. According to Hornby (2001), metalwork is an activity of making objects out of metal in an artistic and skilful way. In other words, it is the use of scientific knowledge in the process of making object from metal in a creative and skilful manner. Technology is the study, mastery and utilisation of the manufacturing and industrial method (Aluwong and Duwa 2009). The systematic application of scientific knowledge to practical tasks in industry and the knowledge of doing things is referred to as technology. Skills acquisition is the bedrock of Technical and Vocational Teacher Education (TVTE) in Nigeria, indeed, education is dynamic, and is a tool "par excellence" for effective national development. Muhammad, (2010) viewed the purpose of technical teacher education as to prepare the teacher adequately for successful training of students' right from junior secondary school to higher level of education. In a broad-spectrum, technical teacher education encompasses the acquisition of strategies, techniques and competencies that can help the teacher to impart knowledge to students. It leads to the production of technicians, technologies, engineers as well as skilled personnel who will function in small, medium and large scale industries/enterprises. The Federal Republic of Nigeria National Policy on Education (NPE, 2013) stated the goals of science and technology as to train the mind in the understanding of the world around and acquisition of appropriate skills, abilities and competence both mental and physical to equip the individual for life and to face the challenges of the society where he belongs. Therefore, ICT as science and technology should be given more emphases in teaching metalwork technology to achieve these stated goals.

Information and Communications Technology (ICT)

Information and Communication Technology is the processing, storing, and distribution of data using computer hardware and software, telecommunications, and digital electronics. In technical term, ICT

can be defined as the use of electronic gadgets for the transmission of information. Information can take many different forms such as text, pictures, sound, video, and multimedia according to Digital Bridge Institute (DBI, 2012). Since ICT involves different and often highly specialised areas, it is often seen as a very daunting subject. Akindolu (2005) in Fagge (2010) viewed ICT as all kind of electronics that are used for broadcasting, telecommunication and all forms of computer-mediated communication. Furthermore, it could be understood that ICT is a technological advancement in the creating, storing, retrieving, and transferring of information with reference to olden day's system of record keeping. Therefore, ICT is used in academia, industry, business, government, healthcare, entrepreneurship etc (DBI, 2012). ICT is also a vital part of our everyday activities, that one manipulates for the purpose of solving one problem or the other. In this regard, it is worth mentioning that while man progress through communication much earlier, the new technology in communication has lifted him more advanced and effective. However, the basis of ICT is simply to help us improve the way we deal with information in all areas of our lives. To this end, ICT has great role to play in achieving the implementation of technical teacher education programme in Nigeria.

Technical Education

Technical education is a type of education designed to develop skills, abilities, understanding, attitudes, work habits, appreciation encompassing knowledge and information needed by workers to enter and make progress in employment in a useful and productive basis (Olaitan, 2001). In other words (UNESCO, 2007) described technical and vocational education as a comprehensive term referring to those aspect of educational process involving, in addition to general education, the acquisition of practical skills, attitude and understanding and knowledge relating to occupations in various sector of economic and social life.

The above mentioned definitions are not contrary in context and meaning from the one stated in the NPE (FRN 2013) "technical and vocational education is the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupation in various sector of economic and social life". According to the National Policy on Education (FRN 2013) the Objectives of Technical and Vocational Education should be:

a. means of preparing for occupation and for effective participation in the world of work
b. an instrument for promoting environmentally sound sustainable development
c. a method of alleviating poverty

By the attainment of these and other objectives, the technical education focused at meeting the followings among other goals:

a. provide trained manpower in applied science, technology and business particularly at craft, advanced craft and technical levels.
b. give training and impart the necessary skill to the individual who shall be self-reliant economically.

Hence, at Technical Teacher Education level in Nigeria students are expected to choose an area of specialization out of the five major areas as stipulated in the National Policy on Education (FRN 2013):

a. automobile technology
b. building technology
c. electrical/electronic technology
d. metalwork technology
e. woodwork technology

In a nutshell, the main objective of the programme is to produce skilled manpower that can successfully participate in the labour market to at least, be self-reliant.

Any of these area is characterized by both theory and practical activities. Successful learning of metalwork technology could only be achieved if practical work are conducted and accomplished

judicially. At this point, the emphasis is on learning of the new technology of conducting practical. The new techniques are guided by computer, known as Computer aided technology or numerically control system. The ideas here will both assist the teacher in imparting the updated knowledge on one hand, and the needed information by the students will be obtained. This is because it is highly important as a technical teacher to disseminate knowledge that is currently in use especially in terms of manufacturing processes (Radiša et al, 2008).

The Position of ICT in Teaching Metalwork Technology

The national policy on education of 2013 has spelt out subjects/trades to be taught at both junior level and senior or technical colleges. In addition to that, the National Commission for Colleges of Education (NCCE, 2012) minimum standard has outlined the courses and credit units to be obtained. The documents have specified nature of teaching and learning materials needed and type of environment ideal for successful outcome.

Advanced countries, where science and technology are recognised as tools for development have already taken advantage of ICT into their educational system. There is no aspect or field of study that ICT is not showing positive impact on both teachers and students. Among all areas of learning science, engineering and technology are dominants in the application of new technology of ICT. In a typical classroom situation, computer have gradually replaced most teaching method. Software programmes are developed to ease learning for both theory and practical components. Learning and instructional materials especially in practical class are carried out with assistance of developed software programme and installed on machine tools. This programme is called numerical control system.

Technical education as a double major, comprises practical and theory. It should account for 54 credits load out of 104 credits load required as a minimum credits load for graduation (NCCE, 2012). Metalwork technology as one of the areas of technical education, it comprises theory and practical. The practical feature is made up of two main components as mentioned by Aluwong and Duwa (2009).

1. **Fitting** - Covers those operations that the engineer performs by hand at the bench. The production of accurate components by hand demands the ultimate in skill from the engineering craftsman.

2. **Machining - C**overs those operations that the engineer performs by employing machines. Components and/or items produced via machines are highly accurate than those produced by fitting work.

There is less involvement of computer-aided instructional work in the fitting work, but the machine is the aspect that computer has completely taken over most instructional techniques in schools and manufacturing work. This is so in advanced countries.

A typical metalwork technology school workshop mostly comprised the following machines as cited by Aluwong and Duwa (2009)

- Lathe machine
- Milling machine
- Shaping machine
- Drilling machine
- Surface grinder

These machine tools and others are now operating numerical control system. This is a system whereby machines are attached to computers through which operations are programmed and coordinated by reading or interpreting mechanisms. The programme controls and manipulates the machine tool table and cutting tool. Mujeeb and Saeed (2013) defined numerical control system as “a method of accurately controlling the movement of machine tools by a series of programmed numerical data which activates the motors of the machine tools”

This new technology in machine operation is the main reason that both teachers and students of metalwork technology need to have knowledge in computer science. This will make everyone to adapt to this new changes in production or manufacturing processes. It should be known that two basic computer programmes are in use for the purpose of teaching and learning which are essential for technical courses in general and metalwork technology in particular.

The two basic ICT programmes are:

- Computer-Aided Instruction (CAI): this is a software programme that guides a user on how to carry out intended work or project. CAI applications include guided drill and practice exercises, computer visualization of complex objects, and computer-facilitated communication between students and teachers (Grabowuski,2008).

- Computer-Aided Design (CAD): is a software for creating precise engineering drawings. Computer-Aided Manufacturing (CAM) is software attached to a machine tool, such as drill or a lather. CAM engineers similarly use computer modelling to determine the best overall manufacturing procedures for use in an industrial plant, including the test and handing of finished products. Engineers use CAD and CAM together to create the design in CAD on one computer, and then transmit the design to a second computer that creates the part using CAM (Grabowuski, 2008).

Going by the history of computer design and manufacturing in the late 1970s and early 1980s, Grabowuski, (2008) described the earliest CAM software as a simple computer attached to a milling machine. Punching buttons on the computer's front panel programmed the software for the machine. In the mid-1980s CAD and CAM have come close together, as some CAM software operates within the CAD software programs instead of through shared database.

It has clearly been explained that the two main tasks cannot be carried out successfully without the knowledge in computer which is the backbone of ICT. It is highly important that students pursuing metalwork technology must learn certain aspect of computer application.

The Need for Blended Learning for Metalwork Technology Students

In a complex society like Nigeria, many factors affect its ICT use and integration. (Mac-Ikemenjima, 2005 in Ololube, 2006).

One of the teaching approaches that is needed for the implementation of the program is "Blended learning" this is a type of leaning models that combine the traditional classroom practice with e-learning solutions. For example, students in a traditional class can be assigned both print-based and online materials, have online mentoring sessions with their teacher via chat, and are subscribed to a class e-mail list. Or a web-based training course can be enhanced by periodic face-to-face instruction. "Blending" was prompted by the recognition that not all learning is best achieved in an electronically-mediated environment, particularly one that dispenses with a live instructor altogether. Instead, consideration must be given to the subject matter, the learning objective and outcomes, the characteristic of the learners, and the learning context in order to arrive at the optimum mix of instructional and delivery methods. This model will be very useful in learning and teaching metalwork technology.

Challenges of Metalwork Technology Teacher Education Programme

Study has revealed that there is a serious mismatch between the qualifications of job seekers and the skill requirements of employers. This is because vocational and technical schools teach skills not relevant to market needs. As most students learned very narrow skills on old machines at schools, they often find themselves unemployed or working as unskilled workers. Most machines in factories, especially those in joint venture companies are new to the students as opined by African Development Fund (ADF, 2005). It has been recognised that unemployment and underemployment pose a serious long-term development challenge to the nation; therefore, the shortage of skilled labour caused by these mismatches is an immediate problem to be tackled in order to bring about economic growth. Ebisine, (2014) argues that

the poor state of facilities and equipment has been a major challenge to academic quality assurance in the college of education. It has been observed that NCCE minimum standard clearly spelt out the facilities, tools and equipment to be provided by institutions offering NCE (Technical). These include; overhead projector, Computer Aided Design, NCCE (2012) which no institution offering this program obtain any of the above mentioned tools and equipment,

Efforts were made to revitalize technical and vocational education under a UNESCO-Nigeria Project 2005. The main activities to be undertaken were: continuing staff development and training for vocational and technical education personnel; curriculum development for existing and new vocational and technical education disciplines; introduction of ICT education into vocational and technical training; and support for initiating feasibility studies for new vocational and technical project. The project has come to a halt as a result of the inability of UNESCO to raise the needed resources ADF (2005).

Conclusion

In a modern society ICT have become key tool and had a revolutionary impact in human endeavour. However, Metalwork technology education as a subject in technical and vocational education in Nigeria, needs ICT as a catalyst for successful teaching of the subject. Through the process of quality education which emphasizes innovations, skills acquisition and managerial ability, ICT should play vital role in teaching metalwork technology. For a successful development of Nigeria's economy and society interdisciplinary and integrated approach should be required in teaching technical education. To this end Modern technological equipment should be provide such as Computer Aided Design, Numerical Control Machine etc.

Recommendations

The following recommendations are made:

- Training and re-training of technical teachers should be encourage by the colleges, particularly in ICT and Blended Learning as well as interactive teaching methods, networks and the sharing of best practices among the academic staff.
- Adequate resources from government should be offered to restructure the current supply-driven technical and vocational education system into a demand-driven system that responds to the country's expanding private sector by rehabilitating and upgrading of metalwork technology workshops as well as tools and equipment.
- Government should endeavour to provide modern technological equipment such as Computer Aided Design, Numerical Control Machine etc. for the use of metalwork technology teachers.

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