

APPLICATION OF ICT IN THE TEACHING AND LEARNING OF CHEMISTRY IN SECONDARY SCHOOLS

Aniekan Monday Udongwo and Simon Walter Umoh

Abstract

Information and Communication Technology (ICT) is defined as a technological tool and resources used to Communicate, create, organize, disseminate, store, retrieve and manage Information. Today's teaching profession requires teachers who have skill and competency in Information and Communication Technology (ICT) to impart adequate knowledge for creativity, skills, new ideas and high level productivity to bring about transformational change in their students. As a result of the discovery of the internet, e-mail, e-systems, digital and metro-digital machines and a host of other information technologies available. ICT has become a vital tool for solving communication problems worldwide. ICT plays an important role in the teaching and learning of chemistry and other related sciences. ICT can be applied in chemistry education through its integration into teaching methods, the use of spreadsheets, database, datalogging and in project base learning.

Education is the most powerful weapon which one can use to change the world. Teaching profession requires teachers who have skill and competencies in Information and Communication Technology (ICT) to impart adequate knowledge for creativity, skills, new ideas and high level productivity to bring about transformational changes in their learners. There is therefore need for secondary school teachers to see ICT learning resources as a priority area of need for integration in classroom teaching and learning. Shift in pedagogy with adequate understanding of ICT learning resources for classroom management skills will provide

needed solutions to emerging societal needs for global competitiveness. World Bank (2002) acknowledge that ICT holds the opportunity to revolutionize pedagogical methods, expand access to quality education and improve the management of the education systems.

Modern technologies are not easy to grasp as conventional ones. Teachers therefore need opportunities to effectively use these new tools to keep abreast with technological innovations and changes. It is imperative to try out new methods, exchange ideas with experts and peers and refine skills that will quickly respond to new developments in various disciplines Davies (2003) and Johnson and Johnson, (2004). ICT also permeates the business environment, underpins the success of modern cooperations and provides governments with an efficient infrastructure. At the same time, ICT adds value to the processes of learning, and in the organization and management of learning institutions. The internet is a driving force for much development and innovation in both developed and developing countries. Education sector should be able to benefit from technological developments. To be able to do so, a cadre of professionals has to be educated with sound ICT backgrounds, independent of specific computer platforms or software environment.

Technological developments lead to changes in work and changes in the organization of work, and required competencies are therefore changing. Gaining in importance are the following competencies (Evgueni K. and Mariana, P. (2002).

1. Critical thinking

2. Generalist (broad) competencies
3. ICT competences enabling expert work decision-making.
4. Handling of dynamic situations
5. Working as a member of a team
6. Communicating effectively

Meaning of ICT

Information and Communication Technology (ICT) is a concept that has become globally appreciated. It has made the world to assume a village status (global village). One can be in his or her office or residence and monitor the events that happen all over the world, as a result of discovery, of the internet, e-mail, e-systems, digital and metro-digital machines and a host of other information technologies available for the use of mankind. Information and Communication Technology (ICT) is a vital tool for solving communication problems worldwide. Its applications are making drastic changes both in economic and social development (Chaka, 2008). According to the European commission (1995), educationally, ICT has proved to be a very powerful tool in education reforms. That is why many countries have now embarked on education reforms, which aim at integrating ICT into their school curriculum. The federal government of Nigeria (2004), in recognition of the importance of ICT in improving knowledge, states in the National Policy on Education that government shall provide necessary infrastructure and training for the integration of ICT in advancing knowledge and skills in the modern world. ICT refers to all kinds of electronic systems that are used for broadcasting, telecommunications and all forms of computer mediated communications. Obi, (2002), Nwachukwu, (2004), Edejiogbo, (2005) define it as a technological tool and resources used to communicate, create, organize, disseminate, store, retrieve and manage information. Chaka (2008) includes computers,

the internet, broadcasting technologies (radio and television) and telephone.

Importance of ICT in the Teaching and Learning of Chemistry

ICT plays an important role in the teaching and learning of chemistry and other related sciences. The classes supported by ICTs play a major role in teaching of chemistry and possible help students examine how often interactive and three dimensions the molecules of a compound, carrying out experiments in virtual laboratory and web pages to get information for their research work, and specifically in the area of chemistry where there are software and instruments that can be connected to computer terminals to obtain more reliable, accurate and even facilitate data collection and graphing.

Another important edge is that the images of compounds or chemical reactions are universal (governed by IUPAC), therefore many resources developed in other countries and other languages can be used without having to make major changes (Hollingworth (2002). In summary, the importance of ICT in teaching the subject of chemistry include:

1. To compliment other forms of learning used in the classroom.
2. To improve understanding of complex concepts that were difficult to address in the traditional way.
3. To remember more easily issues involving data, formulas or specific characteristics.
4. To use computer programmes to represent three dimensional molecules, to rotate in different planes, to access the angles of the links.
5. To relate visually the properties of a molecule with the physical experience of the laboratory.
6. To be able to verify the results of experimentation with the virtual real.

The Benefits of ICT in Science

There is considerable research evidence that learners are more highly motivated when their learning is supported by ICT (Newton and Rogers, 2003).

1. Students are more engaged in activities, they show increased interest and demonstrate a longer attention span.
2. ICT can provide access to a huge range of resources that are of high quality and relevance to scientific learning. In some cases the resources fill gaps where there are no good conventional alternatives; in other cases they complement existing resources.
3. The multi-media resources available enable visualization and manipulation of complex models, three dimensional images and movement to enhance understanding of scientific ideas.
4. ICT widens the range of materials that can be used in teaching and learning to include text, still and moving images and sound, and increases the variety of ways that the material can be used for whole class and individual learning. This means that a teacher can go some way to meeting the needs of students with different teaching styles to modify materials and the way they are used in different and effective ways.
5. ICT can improve the quality of data available to students. Information gleaned from the internet can be more up to date and data obtained from loggers can include more frequent and more accurate experimental readings.
6. Computers also allow repetitive tasks be carried out quickly and accurately so that more students' time can be spent on thinking about the scientific data that has been generated.
7. Many ICT tasks do not require the use of a specific classroom or laboratory. They

can therefore extend learning beyond the teaching space and class contact time, and place the use of ICT at the heart of the learning process rather than as an additional peripheral experience. An activity started in one classroom can be continued in a different room later in the day or at home in the evening.

8. ICT provides opportunities for teachers to be creative in their teaching and in students' learning.

The Application of ICT in Chemistry Education

The application of Information and Communication Technology (ICT) to the teaching of chemistry is through integration in the following learning process and teaching techniques.

Integration of ICT into Teaching Methods Emphasizing Reading and Writing

One of the main aims of this method is to: foster the ability of science teachers to guide their students to utilize the internet, to write analytically, to improve students reasoning ability and to enhance their knowledge and interest in science. While developing this ability, students should be encouraged not to copy the information directly from its source or leave it unprocessed, but acquire information from a number of sources and develop skills to outline, plan, draft, revise and edit writing. Therefore teaching methods that would help students to express their own ideas, criticize and challenge the views of others, and reflect through discussion on changes in conceptual understanding that have occurred should be adopted (Hodson, 1998). Some examples of these methods (reading and writing methods) are different techniques of note-taking and structuring information (e.g concept maps), co-operative or reciprocal reading, progress writing, and writing poems for details see

Bentley and Walts, 1989; Lavonen, Juntti and Meisalo (2007).

Using Spreadsheets: A spreadsheet is a computer application with tools that increase the user's productivity in capturing, analyzing and sharing tabular data sets. It displays multiple cells usually in a two dimensional matrix or grid consisting of rows and columns.

The central features of practical activity in chemistry have always been observation and measurement. The collection of the results of observation and measurement is known as data, and when processed are usually presented in graph or tabular form. For example, students can use spreadsheets to tabulate and calculate results of experiments for individual or group work. The variables in a chemical formula or mathematical equation can be rearranged or changed to see the effects of making any of the variables the subject of the equation. Graphs based on the values entered in the cells can also be generated automatically using the appropriate software. The use of spreadsheets is the clearest and quickest way to demonstrate how manipulating a particular variable produces certain effects. They are useful tools for individual or group work in the chemistry classroom. Spreadsheets have the advantage that most software programmes can easily accept and manipulate information from databases and can create output graphics.

Application of Database in Chemistry: A database is an organized collection of data. Data are stored in databases, managed by computers, which are increasingly being linked together you can design and create to enter and store chemical information into which you can add data. For example, the characteristics of different chemical elements in the periodic table or the characteristics structure and properties of the functional groups in organic compounds e.g. –OH, –COOH etc.

The Use of ICT Tool for the Measurement, Collection and Processing of Chemical Data:- Modern computer technologies can assist in handling and processing of experimental data in chemistry. This process is referred to as DATALOGGING.

Students/teachers can use a word processor to report results of experiments or research they have conducted. The basic parts of a computer aided datalogging system or an ICT measurement system includes: the input (sensors), processor (computer) and output (software-graphs, tables, datahandling). A sensor is a device that is able to respond to the physical property of the environment. A list of some of the sensors required for teaching secondary school chemistry are: temperature sensor, pH sensor, colorimeter sensor, voltage sensor, light sensor, conductivity sensor, absolute sensor, pressure.

Most ICT measurement systems include both hardware (which include an interface unit) and a software. The interface unit converts the voltage signal of the sensor to a digital signal. It is programmed to collect data automatically. Specialized computer software is required so that the computer can interpret and process the signals from the interface unit.

The software usually allows graphs to be produced. One of the major advantages of modern computer-assisted datalogging is that the software captures and instantly graphs the data. This "real-time" graphing encourages discussion on the progress of the experiment. The sensors, interface unit computer and appropriate computer software comprise what is called datalogging system. The real benefits of datalogging come from immediate observations of the data asking questions about them, looking for links with other information, making comparisons, making predictions, looking for trends. Its use is likely to have very positive effect on learning outcomes.

Conclusion

Information and communication technology (ICT) is a global concept widely appreciated and can be used to teach and learn science, especially in chemistry education. This will include the use of spreadsheets, database, datalogging, the internet and world wide web (www) in experimentation, observation, analysis, recording and inference in chemistry education.

Recommendations

The following recommendations are made:

- 1) Teachers should offer to their students varied and meaningful learning and evaluation situations support their learning progress and evaluate their level of competency development.
- 2) Government at the federal and state levels should provide computers and other equipments (e.g. projector) to secondary schools for the integration of ICT into science learning.
- 3) Government should empower teachers by training them in the use of ICT to teach students and
- 4) The government, the community and the school authorities should provide a steady power supply which is needed in the use of ICT in learning.

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- Aniekan Monday Udongwo***
Department of Chemistry,
Akwa Ibom State College of Education,
Afaha Nsit
- And***
- Simon Walter Umoh***
Department of Chemistry
Akwa Ibom State College of Education,
Afaha Nsit.