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EFFECTIVE USE OF ICT IN IMPLEMENTING CHEMISTRY CURRICULUM FOR ENTREPRENEURIAL SKILLS DEVELOPMENT

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Abstract

The study investigated effective use of ICT in implementing chemistry curriculum for entrepreneurial skills development in five selected public senior secondary schools in Uyo Local Government Area of Akwa Ibom State. From the population of 856 chemistry teachers and 2,104 chemistry students a sample size of 56 chemistry teachers and 104 chemistry students were drawn respectively using stratified and simple random sampling techniques. Three research questions guided the study. Instrument used for data collection, was ICT implementation in chemistry curriculum for entrepreneurial skill development Questionnaire. Cronbach alpha was used to determine the reliability which yielded a coefficient of 0.82 and the data collected were analyzed using mean (X) *and standard deviation (SD). Results showed that most senior secondary school chemistry teachers and students lack basic ICT facilities to implement the chemistry curriculum, the schools lacked teachers who possess adequate skills for use of ICT facilities to promote competence in chemistry curriculum implementations for students' knowledge, enhanced skills and creative ways of using ICT to implement the chemistry curriculum. The study, therefore, recommended amongst others that teachers and students should be exposed to industrial attachment for adequate professional and learning competence on use of ICT facilities to boost their knowledge and facilitate effective learning using ICT facilities. There is need for enhanced skill acquisition by teachers to teach chemistry concepts for entrepreneurial development that will promote chemistry enterprises for the market place and for global competitiveness. Suggestions were made for further studies.*

Introduction

Today's workforce demands that employees possess abilities of critical thinking, problem-solving and be ICT complaint in the face of emerging socio-economic challenges. Schools today are faced with ever increasing demands in their attempts to ensure that students are equipped to enter the work force and navigate a complex world (Kurumeh & Chianson, 2012). Researches show that information communication technology (ICT) aids in developing higher order skills of logical and critical thinking, analysis and scientific inquiry. The emerging world therefore needs creative scientists to explore unknown areas and reconstruct its knowledge structure in line with contemporary development. Current knowledge explosion requires more than surface teaching to promote and develop skills for employment and

entrepreneurship. The nation's transformation agenda of becoming one of the world's twenty (20) biggest economies require learners to be adequately provided with necessary basic science skills and learning experiences required for self-development and national sustainability. Thus, the nation's policy on education objectives can only be achieved through the effective implementation of ICT in Chemistry curriculum. By doing this, learners will be adequately equipped with the knowledge and skills needed to be self-reliant, employable and productive to drive the economy.

ICTs offer new teaching and learning experiences to both teacher and student since it provides easy access of information and enables visualization of educational materials in an innovative and realistic way. Inspite of its widespread use globally, Nigeria's educational sector has not given priority to integrating and strengthening the utilization of ICT in its chemistry curriculum implementation to reach a wider percentage of the school populace. Ibeneme (2010) described ICT use as a systematic way of exposing individuals to the practical task of developing and producing goods and services to meet the needs and wants of man. It is the field of study designed to prepare technical and management oriented professionals for saleable employment in business, education and government.

ICT applications consist of hardware, software, networks and media for collection, storage, processing, transmission and presentation of information via; voice, data, text and images (World Bank, 2002). It refers to computational machineries, electronic computerized devices, methods, practices, processes, concepts, and the sciences (FME, 2009), that are associated with human interactive materials that enable the user to employ a wide variety of teaching and learning processes. Technologies used to enhance teaching and learning include; radio sets, television, video discs, computers, smart phones, virtual library, virtual classroom, virtual laboratory, podcast and webcast. The use of these technologies requires skills and competencies which must be acquired by the teacher and learner. The majority of teachers teaching chemistry are reluctant to change and are not current with contemporary technologies and have no knowledge of application of ICTs to equip and sustain students' interest in the subject (Etiubon, 2011) and to qualify them for entrepreneurial skill acquisition (Joshua, 2012) and sustaining job opportunities. Realistic graphic simulation with high quality video enables students to observe scientific processes, industrial processes, role-playing and decision-making processes (Wang and Reeves, 2007; Zhang, 2007). Simulation approach brings reality into the classroom, where conventional practice is out of reach. Interactive media provides visualization and analytical tools which are challenging the nature of inquiry in chemistry. Cox (1996) formulated a series of learning interactions that take place when learners are using simulation such as checking knowledge and understanding, experimenting, visualizing, reasoning and interpreting. Students can perform experiments on the computer in the absence of

real laboratories. Microcomputer-based laboratories (MBLs) represent these applications that are meant as tool in laboratory work. With computer, it becomes much easier to repeat experiments, measure variables, analyze and represent data graphically (Nwojiobi and Nzomiwu, 2006). Students can have lessons presented with presentation software using power-points, e-learning boards, stimulate situations, improve their knowledge base, explore authentic issues, work with peers and experts across the globe, select the mode they prefer and work at their own pace (Sadkar and Sadkar, 2003). Access to ICT facilities then becomes a matter of critical importance for the teacher who must be viable, resourceful and able to adapt to emerging technologies for effective teaching of its learners to provide them with adequate skills, knowledge, innovative and creative ideas with capacity for self-reliance in a technology-driven and economic competitive world. This will facilitate learners' interest in building their own knowledge and exploring the use of ICT facilities in more meaningful ways for learning chemistry and for occupational opportunities. Chemistry is an artistic enterprise which offers a lot of occupational opportunities in areas like manufacturing of goods such as pharmaceuticals, foodstuffs, packaging detergents, soaps, flavours, fragrance, paints, candles, metals, textiles, agricultural products; sales of goods; analytical and consultancy services and researching (Kelle, Ibekwe & Oguezi, 2012). The teacher is the implementer of the curriculum and so must keep pace with constantly emerging technologies and changing global markets for effective implementation of the chemistry curriculum. Policy implementation of the chemistry curriculum should then be made to be proactive by teachers in its agitation for provision of ICT facilities for teaching. Teachers need to build higher order skills on ICT use in teaching entrepreneurial concepts in the curriculum to enrich learners' skill acquisition on the subject. This will enable them compete in a digitized and networked society. Chemistry curriculum implementation with ICT use will enable teachers' design techniques in creating models for entrepreneurial skill development that will encourage learners compete favourably in the market place. They should be prepared to operate school curriculum in such a way to encourage creativity, adaptability and independence (Ikeobi, 2010).

Runi & Bitiyak (2004) noted that the productive capacity of a nation depends on the quality and competence of its teachers and maintained that the teachers of science, technology and mathematics (STM) in Nigerian schools are the hub of technological progress in Nigeria. It is certain that Nigeria can compete technologically with the developed nations if the teachers of chemistry are adequately prepared and their competence sustained through training on entrepreneurial skill acquisition. The earlier the child loves and appreciates enterprising chemistry teaching and uses it in other areas of need, the better the overall productive progress of the child in the knowledge of chemistry. Students' knowledge of entrepreneurial skills using ICT depends to a large extent on the orientation, competence and skills of their

teachers. They are aware that chemistry affects their everyday life and that being exposed; they can be enabled to make informed choices and decisions.

Adeyegbe (2005) posited that non-provision of ICT facilities for practical use in school laboratories contribute immensely to students' lack of interest in acquiring effective entrepreneurial skill development. Maredia (2007) also opined that focusing on imparting skills and abilities that are transferable to a wide range of occupations will influence the desired characteristics expected of the curriculum. Proper use of ICT in implementing chemistry concepts for entrepreneurial skill activity calls for a teacher education programme that is different from what is currently being used in most teacher colleges and universities. New materials and new techniques of using ICT need to be provided and effectively deployed for learners' entrepreneurship skill development.

Entrepreneurial skill may be termed as the act of acquiring skill for productivity for wealth creation in line with global best practices. It involves discovering new ways of combining resources for greater market value. Nzekwe (2011) defined entrepreneurship as the process of identifying, developing and bringing a vision to life. The vision may be an innovative idea, an opportunity or a creative way of making objects mature into fruition. Kelle, Ibekwe and Oguezi (2012) stated that functional chemistry education emphasizes applicability or transfer ability of knowledge when a student undergoes training and acquires appropriate skills and competences that enable him/her contribute to the development of society. Any hardworking, industrious, skilful, productive and enterprising person transmits the culture to the nation and institution thereby raising the standard of living. Entrepreneurial skill development includes productive tools such as market research survey, creating business plan, raising funds to meet target production, locating right business premises, learning promotional skills for marketing and advertising products, understanding legal procedures for company registration of products in agencies like Nigeria Corporate Affairs Commission. This is quite cumbersome and requires ICT facilities integrated in chemistry curriculum for teaching knowledge-based chemistry entrepreneurial skills for learners' employability beyond school. Akpan (2010) observed that skills, experiences, decisions and interactions with industrial exposure of teachers to acquire practical experience when taken consciously results in the formation of viable in implementation of chemistry curriculum business careers. Hence, industrial training, using ICT is needed by teachers to motivate and stimulate students' interest in entrepreneurial skill development.

Entrepreneurship education is designed to make youths acquire relevant skills to become wealthy through entrepreneurial preparations and become self-employing and self-sustaining using research studies from local raw materials for fruit juice production, cassava products for chips, adhesives, starch and flour, enzymes, shoe and leather works; ceramics and metal refining and cement production. Developing a chemistry

curriculum with ICT application exposure on entrepreneurial skills for productivity will make learners work ready and bring quality into classroom diversification of learning contents and experiences. This will bridge the productivity gap and fast-track chemistry curriculum that prepares youths on ICT use for entrepreneurial skill development to meet technological changing needs and stimulate the economy for employment and provision of human resources.

Statement of the Problem

Chemistry is a practical subject that requires the knowledge of ICT. The laboratories are not equipped with ICT facilities; the teachers lack ICT knowledge, hence, they are engaged in teaching chemistry principles and concepts without any practical demonstration using ICT. The students are therefore denied the opportunity to gain the practical knowledge they need for entrepreneurship and self-reliance. With the society becoming increasingly technological, teachers need highly specialized ICT skills to teach entrepreneurial practical activities on chemistry concepts.

Purpose of the study

The main purpose of this study was to investigate the effective use of ICT in implementing chemistry curriculum for entrepreneurial skills development. Specifically, this study attempts to answer the following research questions.

Research Questions

1. What ICT facilities are used in implementing chemistry curriculum for entrepreneurial skill development?
2. What is the level of teachers' competence in the use of ICT facilities in implementing chemistry curriculum for entrepreneurial skill development?
3. What is the level of students' competence in the use of ICT facilities in implementing chemistry curriculum for entrepreneurial skill development?

Methodology

The study adopted a survey research design. The study covered five selected secondary schools in Uyo Local Government Area of Akwa Ibom State. Chemistry teachers' population stood at eight hundred and fifty-six (856) with two thousand one hundred and four (2,104) chemistry students. Fifty-six (56) Chemistry teachers and one hundred and four (104) students from five secondary schools, selected through stratified and random sampling techniques formed the samples for this study.

The instrument for data collection was ICT implementation in chemistry curriculum for entrepreneurial skill development Questionnaire. The instrument was structured on a 4-point rating scale of Strongly Agree (SA=4), Agree (A=3) Disagree (D=2) and Strongly Disagree (SD=1).

Face validation of the instrument was done by two computer scientists and two vocational education lecturers in the University of Uyo, Uyo. Cronbach alpha was used to test the reliability of the instrument with reliability

established at 0.82. Mean $(\overline{X})$ and Standard Deviation (SD) were used to analyze the data collected. Mean $(\overline{X})$ score below 2.50 was not accepted but a mean of 2.50 and above was accepted.

Results

The data were analyzed and presented as follows:

Research Question 1: *What ICT facilities are used in implementing chemistry curriculum for entrepreneurial skill development?*

Table 1: Mean ratings of teachers' responses on ICT facilities in chemistry curriculum for entrepreneurial skill development.

S/N	Item statement	$\overline{X}$	SD	Remark
1	Computers and accessories	3.18	0.91	A
2	Smartphones/teleconferencing	2.98	0.80	A
3	Video discs	3.08	0.52	A
4	Virtual library	2.81	0.46	A
5	Virtual classroom with animation	2.92	0.73	A
6	Virtual laboratories with simulation	3.15	0.87	A
7	e- learning boards	2.81	0.46	A

Table I showed high mean ratings on chemistry teachers' response on ICT facilities in chemistry curriculum for entrepreneurial skill development. The ICT facilities include; computers and accessories, smart-phones through teleconferencing for collaborative connection, videodiscs for recording lessons for future studies, virtual library for intra and inter connectivity, virtual classroom with experiments and engaging tasks, virtual laboratories using simulation and e-learning boards for audio and visual learning experiences on entrepreneurial concepts in chemistry.

Research Question 2: *What is the level of teachers' competence in the use of ICT facilities in implementing chemistry curriculum for entrepreneurial skill development?*

Table 2: *Mean ratings of teachers' competence on ICT facilities in implementing chemistry curriculum for entrepreneurial skill development*

S/N	Item statement	$\overline{X}$	SD	Remark
8	Formulate ICT specific objectives for entrepreneurial skills	3.31	0.56	A
9.	Restructure objectives periodically to meet with ICT changing needs	2.84	0.86	A
10	Develop software programmes on entrepreneurial concepts in chemistry	3.24	0.71	A
11	Connect sources of entrepreneurial sites on website for appropriate concept teaching	2.92	0.69	A
12	Identify relevant entrepreneurial opportunities and needs to concentrate	3.27	0.70	A
13	Identify entrepreneurial outlets for increased knowledge collaboration	2.93	0.69	A
14	Identify relevant sources to promote exchange of entrepreneurial ideas	3.42	0.62	A

Table 2 showed that chemistry teachers do not have competence on use of ICT facilities in implementing chemistry curriculum for entrepreneurial skill development. The high mean ratings responses by all the items depicts the incompetence of the chemistry teachers in the use of ICT facilities. Formulating specific objectives, periodically restructuring objectives to meet rising ICT changing demands, developing software programmes on entrepreneurial concepts, connecting sources of entrepreneurial sites, identifying opportunities and outlets to promote exchange of ideas on entrepreneurial skills are lacking in the absence of ICT use by chemistry teachers for learners entrepreneurial skills acquisition.

Research Question 3: *What is the level of students' competence in the use of ICT facilities in implementing chemistry curriculum for entrepreneurial skill development?*

Table 3: Mean rating of students' competence on ICT facilities in implementing chemistry curriculum for entrepreneurial skill development

S/N	Item statement	X	SD	Remark
15	Computer labs not available for knowledge on entrepreneurial skill development	3.58	1.01	A
16	Appropriate curriculum contents for selecting entrepreneurial skills	2.64	0.74	A
17	Software packages for learning entrepreneurial skills	2.99	0.81	
18	Creative skills for browsing to gain ideas on entrepreneurial activities	3.15	0.83	A
19	Utilization and selection of ICT entrepreneurial skills using ICT facilities	2.86	0.72	A
20	Learning experiences gained on entrepreneurial skill development on internet	3.39	0.84	A

Table 3 revealed high mean ratings on all item responses of chemistry students' competence on ICT facilities in implementing curriculum for entrepreneurial skills development. The high mean rating responses of students showed that ICT laboratories for knowledge of skill acquisition, appropriate content selection of curriculum topics, software packages for learning, creative skills for browsing, utilization and selection of contents for learning experiences using ICT facilities are competences they lack for entreprencurial skill development.

Discussion of Findings

The findings of study in Table 1 have shown that ICT facilities used in implementing learning experiences in chemistry curriculum for entrepreneurial skill development are lacking as most senior secondary schools teaching and offering chemistry as a course do not have ICT laboratories to facilitate entrepreneurial skill development in its learning. This agrees with Adeyegbe (2005) that non-provision of ICT facilities for practical use in school laboratories contribute immensely to students' lack of interest

for effective entrepreneurial skill development. Maredia (2007) also corroborated that imparting skills and abilities that are transferable to a wide range of occupations will influence the desired characteristics expected of the curriculum. Exposing teachers and students to industrial attachment and encouraging cottage industries' will empower learners with the necessary skills, knowledge and competencies for marketing and engaging productivity. Findings in Table 2 showed that chemistry teachers do not have competence on use of ICT facilities for implementing chemistry curriculum for entrepreneurial skill development. This corroborates the findings of Runi and Bitiyak (2004) that the productive capacity of a nation depends on the quality and competence of its teachers and Akpan (2012) observed that skills, experiences, decisions and interactions with industrial exposure of teachers to acquire practical experience will result in the formation of viable business careers. This will give market-value to students learning experiences on concepts in the chemistry curriculum involving entrepreneurship education.

Findings in Table 3 revealed students lack of competence on use of ICT facilities in implementing chemistry curriculum for entrepreneurial skill development. This supports the findings of Kelle, Ibekwe and Oguezi (2012) that functional education emphasizes applicability or transferability of knowledge when a student undergoes training and acquires appropriate skills and competence that enables him/her contribute to societal development. A thriving and an enabling student learning environment with ICT facilities will fast-track learners productivity through enabling entrepreneurial chemistry studies.

Conclusion

ICT facilities provision for chemistry curriculum implementation for entrepreneurial skill development will tackle most of Nigeria's economic challenges such as youth unemployment and address the appropriate harnessing of local raw materials to build knowledge-creation systems for marketing-value among its learners.

Recommendations

1. The curriculum planners should design and create trade concepts on chemistry curriculum to fabricate and engage ICT deployment in chemistry curriculum for responsiveness.
2. Capacity building using industrial attachments should be encouraged for teachers' exposure on use of ICT facilities for teaching chemistry concepts on entrepreneurship.
3. Chemistry curriculum content should be diversified to accommodate professional needs, skills and interest groups to emphasize entrepreneurial training skills using ICTs to enhance teachers and learners interest.
4. Continuous updating of the curriculum is needed to address charging learning needs and skills for productivity.
5. Skill enhancement strategies using technological incubation centres to position graduates for life productivity should be in place.

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