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Skills Acquisition in Chemistry Education and Youth Empowerment

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ABSTRACT

This study investigated skills acquisition in Chemistry education for youth empowerment. A descriptive survey design was adopted. The population of the study was made up of two thousand, one hundred and nine (2,109) senior secondary (III) Chemistry students in the 14 Government owed secondary schools in Obio-Akpor Local Government Area of Rivers State. The two hundred (200) senior secondary (111) Chemistry students used as sample were obtained from five schools with fairly equipped science laboratories that could sustain most of the practical prescribed in the senior secondary school chemistry curriculum. Purposive sampling was used to select the schools as well as one intact class in which all the students offer chemistry in each school. The instrument for data collection was a structured questionnaire of thirty-five (35) items divided in three sections (a , b and c) which elicited information on the extent of use, availability, usability and the influence of the innovative teaching methods that enhance skills acquisition in Chemistry. It also elicited information on the skills acquired by the Chemistry students. The instrument was validated by 2 experts in science education(one biology and Chemistry options) ,as well as an expert in test and measurement.. A reliability coefficient of 0.76 was obtained using a test-retest method to obtain data and Pearson Product Moment correlation statistics.. In order to make decisions, a mean reference of 2.5 on a Modified 4 points Likert Scale was used. The result showed that students learnt better and acquired scientific skills when the teaching methods allowed active participation and interaction with the learning materials (hands on Activities). The result also revealed that students were able to acquire acquisitive and communicative skills. Sequel to the findings, the study recommended that the teaching-learning interaction in chemistry should be activity-oriented for the development of skills useful for enhancing productivity.

Introduction

The world is ever changing and a close observation of the world's progression for a few decades reveals clearly that the world has become a more independent place in which youths have a better chance of discovering themselves and their community. The global economic problem in general and Nigeria in particularly has given rise to the devaluation of currency and naira respectively. Hunger, poverty, and increase in crime rate as well as unemployment are clear evidence that self-employment and self- reliance are some of the keys to surviving the present situation. As such, the reliance of Nigerian youths on the labour market for white collar jobs after graduation is no longer the ultimate. Education is an instrument of change and empowerment. Therefore, science education today particularly Chemistry is taught to develop holistic individuals capable of becoming creators of jobs that can contribute positively to economic and national development.

The goal of Chemistry education as stated in the Nigeria philosophy of education is to help students acquire science process skills. It is also to ensure the development of the physical, mental and social abilities as well as competencies as a tool to promote entrepreneurship opportunities. In other words, Chemistry education is aimed at producing individuals who can be self-employed, self-reliant and self-sufficient. Chemistry utilizes process skills which are mental tools used in the discovery and acquiring of scientific knowledge. The implication of this is that teachers need a change of approach to the process of teaching and learning of Chemistry. In other words, learner – activity centered approach with well develop lesson contents using process skill pedagogy should be utilized. This stimulates students' interest and motivates them to learn in order to acquire relevant skills for individual empowerment and sustainability for national development.

The broad aim of secondary education within the overall national objectives is the preparation for useful living within the society; equipping students to live effectively in the modern age of science and technology (www.ibe.unesco.org>countries).The Federal Government of Nigeria (FGN, 2013 p.8) National Policy on Education stated that science education shall specifically emphasis the teaching of science process and principles. Thus, the importance of skills acquisition in Chemistry education cannot be overemphasized. Skills are abilities which can be developed not necessary in-born but manifests in performance but not merely in potentials. The level of education does not have a significant effect on one's growth, rather the effect is more pronounced on the level of skills possessed and the ability to apply the skills in the real world of work (Oladim, 2002 and Okolocha, 2006).

Therefore, Lawal (2009) in Ojiaku, Udogu and Egbuacho (2013), opined that "Nigeria education at all levels must be geared towards equipping future generation with necessary skills, knowledge and attitude for coping with the ever demanding world of science and technology. However, this is not so in the society today as most Nigerian youths after graduation lack the necessary skills which could make them employable or self-employed citizens as contained in the national policy on education. Therefore, teaching for the acquisition of scientific skills essential to perform entrepreneurial task or that will develop students' proficiency in both public or private establishment (work) should be the main focus in youth education as a tool for youth empowerment.

Statement of the Problem

Youth empowerment is a major concern for all especially with the increasing rate of youth unemployment. The Global unemployment Trend for Youth, 2015 shows a reduction in the number of unemployed youths to 73.3 million in 2014, some 3.3 million less than the crises peak of 76.6 million in 2009. However, Elder Sara (2015), the report's lead author stated that almost 43 percent of the global youth labour force is still either unemployed or working yet living in poverty" (www.un.org>apps>news). More than 70 percent of senior secondary school leavers find it difficult to gain admission into higher institution in the last five years while 60 percent of graduates are unable to secure employment immediately after graduation because they are relatively unskilled (Millennium Development Goal (MDG) 2005).

Similarly, the National Bureau of Statistics (NBS), (2014-2016), stated that "youth unemployment rate in Nigeria increased to 21.50 percent in the first quarter of 2016 from 19 percent in the fourth quarter of 2015. In 2014, unemployment rate was an average of 16.43 percent in the first quarter and 11.70 percent in the fourth quarter of 2014 (NBS.www.informtion.com). Thus, it is essential to provide quality education that focuses on skills acquisition rather than acquisition of scientific facts and principles. As such, in order to address this, it has become imperative for the instructional approach to be student-centered, activity-based and can be related to work environment. This study therefore seeks to ascertain the instructional approach that can be utilized for student to develop the relevant skills such as Acquisitive skills, Organizational skills, Creative skills, Manipulative skills and Communicative skills in Chemistry education.

Objectives of the Study

The purpose of the study is to examine the acquisition of skills through Chemistry education for youth empowerment. It specifically seeks to;

1) Identify the skills that students have learnt in Chemistry with which they can be self-reliant or self-employed.
2) Examine how innovative instructional methods can facilitate understanding and skills acquisition in Chemistry instructions.
3) Investigate the availability of relevant and functionality of instructional or training facilities that can enhance skills acquisition.

Research Questions

The study was guided by the following research questions:

1) What are the skills that students have learnt in Chemistry with which they can be self-employed or self-reliant?
2) To what extent does the use of innovative instructional methods facilitate understanding and skills acquisition in Chemistry education?
3) To what extent are relevant and functional teachings or training facilities that can enhance skills acquisition in Chemistry available in secondary schools?

Research Methodology

Descriptive survey design was adopted for the study. This is because it involved the collection of opinions from students on the teaching methods that can lead to the development and acquisition of skills. Two thousand, one hundred and nine (2,109) senior secondary (III) Chemistry students from the fourteen (14) government approved secondary schools in Obio-Akpor Local Government Area of Rivers State constituted the population. This comprises of 895 males and 1,214 females. 200 senior secondary (III) Chemistry students constituted the sample size selected through purposive sampling technique. The availability of chemistry laboratory which is fairly equipped was a criterion used to select five schools for the study. Also purposive sampling was used to select an intact science class in which all the students offer chemistry.

A structured questionnaire tagged YEQ (Youth Empowerment Questionnaire), divided into three sections with a total of 35 items (5, 10, and 20 items for sections A,B and C) structured on a modified four point Likert Rating Scale of High Extent (4 Points), Average Extent (3 Points), Low Extent (2 Points), Very Low Extent (1 Point) was used. Section A was designed to elicit students responds on the extent of skills acquired in chemistry lessons, Section B focused on the extent to which use of appropriate instructional method can enhance acquisition of concept or topic. Section C on the other hand was designed to find out the extent of use and the influence of improved or innovative methods of teaching Chemistry used by teachers in chemistry instruction.

Table 1. Mean, Standard Deviation on skills that students have learnt in Chemistry with which they can be self-employed (N = 200).

S/N	Item Different skills that can be acquired during chemistry instructions	High Extent	Average Extent	Low Extent	Very Low Extent	Mean	S.D	Decision
1	Because of the way the Chemistry teacher taught, I can gather information (i.e. Acquisition skills).	8 (4%)	63(31.5%)	92(46%)	37(18.5%)	2.69	.67	Accepted
2	Because of the way the Chemistry teacher taught, I can put information in a systematic order (i.e. Organization skills)	1 (.5%)	42(21%)	110(55%)	47(23.5%)	1.98	.68	Rejected
3	Because of the way the Chemistry teacher taught, I can develop new approaches and new ways of thinking (i.e. creative skills)	4 (2%)	28(14%)	111(56%)	56(28%)	1.90	.70	Rejected
4	Because of the way the Chemistry teacher taught, I can handle materials and instruments effectively (i.e. manipulative skills).	1(.5%)	34(17%)	92(46%)	73(36.5%)	1.80	.70	Rejected
5	Because of the way the Chemistry teacher taught, I can relay and transfer information correctly (i.e. communicative skills).	2(.5%)	39(19.5%)	86(79%)	72(36%)	3.12	.69	Accepted

Source: Field Survey (2016).

Table 2. Mean, Standard Deviations on Students Responses on Chemistry topics and the practical application of the appropriate teaching methods that enhance skills acquisition. (N=200).

S/N	Item	High Extent	Average Extent	Low Extent	Very Low Extent	Mean	S.D	Decision
1	I would have understood introduction to chemistry and chemical industries if we had gone for an excursion to chemical industries where they produce substances such as paints, plastics, margarine, vegetable oil, etcetera.	139(69.5%)	44(22%)	8(4%)	9(4.5%)	3.56	.77	Accepted
2	I would have understood particulate nature of matter if the Chemistry teacher demonstrated what he/she was teaching.	107(53.5%)	69(34.5%)	19(9.5%)	5(2.5%)	3.39	.76	Accepted
3	When we learnt symbols, formulae and equations, I would have understood better if we had performed experiments and reported the result to illustrate the law of conservation of mass, law of constant composition etcetera.	130(65%)	53(26.5%)	11(5.5%)	6(3.0%)	3.53	.73	Accepted
4	While teaching the separation techniques, if the teacher had demonstrated the process using separating apparatus to separate some substances, I would have understood better.	133(66.5%)	44(22%)	15(7.5%)	8(4%)	3.51	.80	Accepted
5	I would have understood the process of titration if it was demonstrated by the teacher and if we were also guided by the teacher to be involved in the process, measuring and recording the results correctly.	133(66.5%)	49(24.5%)	14(7.0%)	4(2.0%)	3.55	.71	Accepted
6	It would have been more interesting if the Chemistry teacher took us for excursion to water works to observe the water treatment procedure and the distillation process.	129(64.5%)	50(25%)	13(6.5%)	8(4.0%)	3.50	.78	Accepted
7	I would have understood better if the teacher demonstrated the electrolysis of acidified water using Hoffman's apparatus constructed in the laboratory.	126(63%)	55(27.5%)	1396.5%)	5(2.5%)	3.51	.73	Accepted
8	I would have learnt how to produce alkanols, if the teacher had demonstrated the production of ethanol by fermentation.	112 (56%)	59 (29.5%)	19 (9.5%)	10 (5.0%)	3.36	.85	Accepted
9	It would have been very interesting if we had visited a petrochemical industry to observe the distillation of the mixtures of petroleum products.	136 (68%)	39 (19.5%)	12 (6.0%)	13 (6.5%)	3.49	.87	Accepted
10	I would have learnt how to make soap if the teacher had taught saponification by demonstrating the process in the laboratory.	142 (71%)	38 (19%)	11 (5.5%)	9 (4.5%)	3.56	.79	Accepted

Source: Field Survey (2016).

The instrument was validated by experts in Chemistry and science education. Reliability coefficient was established to be 0.76, 0.78 and 0.74 for sections A, B and C respectively using test-retest method and Pearson's Product Moment Correlation.

Data collected were analyzed using frequency count, percentage, mean and standard deviation for the three research questions.

Research Question 1

What are the skills that students have learnt in Chemistry with which they can be self-employed or self-reliant?

Table 1 shows that students have acquired the 'Acquisitive Skills' and 'Communicative Skills' to a high extent with a mean values of 2.69 and 3.12 respectively while organization skills, creative skills and manipulative skills are of low extent with mean values of 1.98, 1.90 and 1.80 respectively.

Research Question 2

To what extent does the use of innovative instructional methods facilitate skills acquisition in Chemistry Education.

Table 2 shows that the extent of the application of appropriate teaching methods as described in the senior secondary Chemistry curriculum for the teaching and learning of Chemistry contents in order to enhance skills acquisition is of high Extent of non usage with mean values 3.56, 3.39, 3.53, 3.51, 3.55, 3.50, 3.51, 3.36, 3.49 and 3.56. In other words, Chemistry teachers are not utilizing the activity oriented teaching methods necessary for skills acquisition.

Research Question 3

To what extent are relevant and functional teachings or training facilities that can enhance skills acquisition in Chemistry available in secondary schools?

Table 3 shows that variables 1 – 4 have mean values 2.89, 3.94, 3.96 and 3.98, which reveals that the use and the influence of the improved or innovative methods of teaching Chemistry are to a high extent not in use. That is, students would have understood better if they were exposed to certain processes of learning or learning environment by the teacher. Similarly, variables 5-11 with mean values 2.11, 1.89, 1.80, 1.83, 1.79, 1.59 and 1.66 show that the method or approach used by the Chemistry teacher does not impact much on the students in terms of being able to acquire and process relevant knowledge. Thus, students' responses show low extent of the teaching approach helping them to learn and acquire skills. Also, variables 11 and 13 with mean values 3.62 and 3.71 show that the laboratories are deficient with old equipment which is not functional. And where they are available, students do not often utilize them for practical activities. Finally, variables 16-20 with mean values 1.04, 1.02, 1.00, 1.02 and 1.00 shows low extent of students being able to apply what they were taught, basically because of the methods or the approach of presentation.

Table 3. Mean, Standard Deviation on students responses on the Extent of use and the influence of the improved or innovative methods of teaching Chemistry. (N=200)

S/N	Item	High Extent	Average Extent	Low Extent	Very Extent	Mean	S.D	Decision
1	The method of teaching used by the Chemistry teacher helps me to understand what is taught.	1(.5%)	178(89%)	20(10%)	1(.5%)	2.89	.33	Accepted
2	I would have understood the topic better if we were given an assignment to work in a group.	189(94.5%)	11(5.5%)	-	-	3.94	.22	Accepted
3	I would have understood the topic better if we had gone for an excursion.	194(96%)	5(2.5%)	1(.5%)	-	3.96	.20	Accepted
4	I would have understood the topic better if the Chemistry teacher demonstrated what he/she was teaching.	196(98%)	4(2%)			3.98	.140	Accepted
5	Because of the way the Chemistry teacher taught, I am able to think well like a scientist.	11(5.5%)	24(12%)	142(71%)	23(11.5%)	2.11	.66	Rejected
6	The way the Chemistry teacher presented the lesson helped e to visualize the topic taught.	4(2%)	10(5%)	146(73%)	40(20%)	1.89	.56	Rejected
7	Because of the way the Chemistry teacher presented the lesson I have been able to practice what I was taught.	1(.5%)	5(2.5%)	147(47%)	47(23.5%)	1.80	.49	Rejected
8	I can apply the knowledge I acquired in Chemistry class when I have similar issues at home or anywhere.	1(.5%)	11(5.5%)	141(70.5%)	47(23.5%)	1.83	.53	Rejected
9	Because of the way the Chemistry teacher taught, I can organize things better and think very well.	1(.5%)	10(5%)	136(68%)	53(26.5%)	1.79	.54	Rejected
10	The Chemistry teacher engages or exposes us to practical activities.	-	1(.5%)	117(58.5%)	82(41%)	1.59	.50	Rejected
11	I had opportunities of using the laboratory equipment for practical.	-	2(1%)	128(64%)	7035%)	1.66	.49	Rejected
12	The available laboratory equipment are old or not in good state.	130(65%)	66(33%)	3(1.5%)	1(.5%)	3.62	.54	Accepted
13	The equipmentare in the laboratory but we are not allowed to use them for practice.	153(76%)	40(20%)	3(1.5%)	4(2%)	3.71	.59	Accepted
14	The Chemistry laboratory is functional for practical during the after teaching.	-	2(1%)	120(60%	78(39%)	1.62	.50	Rejected
15	The way the Chemistry teacher present the lesson encourages students to ask and also answer questions.	-	18(9%)	136(68%)	46(23%)	1.86	.54	Rejected
16	With all I have learnt in Chemistry I can set up chemical apparatus and manipulate them.	-	-	9(4.5%)	191(95.5%)	1.04	.20	Rejected
17	With all I have learnt in Chemistry I can confidently carry out acid-base titration, measure and record the result.	-	-	5.2(2.5%)	195(97%)	1.02	.15	Rejected
18	With all I have learnt in Chemistry I can extract indicators from flowers and coloured plants.	-	-	1(.5%)	199(99.5%)	1.00	.07	Rejected
19	With all I have learnt in Chemistry I can make soap using chemical or local materials.	-	-	1(.5%)	198(99%)	1.02	.22	Rejected
20	With all I have learnt in Chemistry I can produce ethanol by fermentation.	-	-	-	200(100%)	1.00	.00	Rejected

Source: Field Survey (2016).

Discussion of Findings

The findings show that students will learn better and acquire the necessary skills, if taught using innovative teaching methods that are student-centered and activity-oriented. This is in agreement with the findings of Arokoyu (2011), which established that skills acquisition in science teaching depends on the teaching methods and the materials used as well as the level of students' participation in the learning process. The result is also consistent with the findings of Nna and Dike (2016), which opined that students learn better when taught using innovative instructions.

The findings of the study in terms of the skills acquired by the students revealed that only the acquisitive skill and communicative skills have been acquired to a high extent by the students while the organizational, creative and manipulative skills have to a low extent been acquired by the students. This is simply because the appropriate teaching methods that can expose students to designing new problems, create methods for solving problems, setting apparatus etcetera have not been adequately utilized. Thus students acquire only those skills which the learning process has exposed them to. The implication of this is that level of exposure given to students by the Chemistry teacher will to large extent determine the skills the students acquire. And the more skills an individual acquires, the more knowledge he/she has with which to make decision (Anele, 2004). Therefore, the role of the teacher is to develop content that utilize models of learning that will stimulate and motivate learners to acquire the necessary skills that can lead to a sustainable living and economic growth and development.

The study also revealed that Chemistry laboratories are not in good state nor functional for students to practice. The importance of Chemistry laboratory cannot be overemphasized. This is because the laboratory is an integral part of the school that provides real or first-hand experiences for the students.

Chemistry is activity oriented and required well equipped and functional laboratory. In other words, using the laboratory allows the students to explore chemical concepts, view changes in matter and acquire scientific process skills. Thus, the emphasis now should not just be on what is taught (i.e. the content) but on how it is taught (i.e. the method and process). This is because students can only apply what they have practiced during the teaching and learning process. Hence, the use of activity-based strategies in teaching Chemistry which produces better knowledge and enhance skills acquisition should be effectively utilized.

Educational Implications of the Study

The major finding of this study is that student will learn better and acquire the necessary skills if taught using innovative teaching methods that are student-centred and activity–oriented. The implication of this is that Chemistry teacher should prepare and develop lessons rich in content which will provides students with practical learning experiences. In other words, practical activities should be an integral part of teaching and learning Chemistry. Hence, the Chemistry teacher should identify relevant Chemistry industries where students can visit or go for excursions so as to have fundamental practical experiences in order to compliment the theoretical aspect taught in the classroom.

The study also revealed that only the acquisitive skills (i.e. listening, observing, formulating questions, etcetera) and the communicative skills (i.e. formulating and asking questions, listening to others etcetera) have been acquired to a high extent. The implication of this is that students should be involved in hands-on-activities where they learn Chemistry by doing. This will enhance the acquisition of organizational, creative and manipulative skills.

Also, the implication of the study in terms of the non-availability of functional laboratory is that government and school heads should ensure that laboratories and learning resources are provided and functional.

Conclusion

The study has shown that there are skills inherent in Chemistry education which can be developed if students are exposed to Chemistry contents using appropriate and practical oriented teaching methods. It is therefore, the role of the teacher to teach the students with methods that will enable them visualize, organize, think, manipulate and practice the contents taught. Thus, engaging Chemistry students in practical activities is a viable tool for skills acquisition for self-reliance and self-sufficiency among the youths.

Recommendations

Based on the findings, the following recommendations were made:

1. Chemistry teachers should embrace the use of activity-oriented and student-centred methods that involve student in the teaching and learning process by providing them with relevant learning materials as well as appropriate environment.
2. Seminars and workshops on the use of innovative teaching methods that enhance skills acquisition should be organized for Chemistry teachers.
3. School principals and heads of science department should ensure Chemistry teachers are provided with enabling environment for science teachers to utilize teaching methods relevant for skills acquisition.
4. Finally, government should take science education more serious by providing well equipped and functional laboratory.

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