

KNOWLEDGE, AWARENESS AND PRACTICE OF SOCIO-ECONOMIC RELEVANCE OF CHEMISTRY EDUCATION AMONG UNDERGRADUATES IN OYO TOWN, NIGERIA

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Abstract

Chemistry Education has been identified to be one of the major bedrocks for the transformation of a Nation's economy and it's much needed for the desired sustainable development. Chemistry Education has a vital role to play in helping to find answers to various human and socio-economic problems as well as making the society more scientific literature. The study examined the knowledge, awareness and practice of undergraduates of socio-economic relevance of Chemistry Education among undergraduates in Oyo town, Nigeria. A descriptive design method was adopted. 80 students were selected using a simple random sampling technique, thus, 40 students were selected from each of the two universities (Emmanuel Alayande University of Education and Atiba University in Oyo town, Oyo State). Sample percentage analysis was used to analyze the research questions. The findings revealed that Chemistry is very important in transforming waste to wealth. In essence, Chemistry is indispensable for socio-economic growth of a nation. It was concluded that awareness, knowledge and practice of Chemistry education has assisted undergraduates' socially and economically. Among the recommendations made were that Chemistry should be made compulsory to all students in secondary and tertiary institutions irrespective of discipline and that Government both at the Federal and state level should promote regional and international symposium specifically targeted towards achieving the goals of the building self-reliant generation which in turn will enhance socio-economic growth.

Keywords:

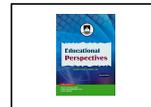
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Introduction

Education is central in the development of any economy and nation. It is important to the development of the human resources, impartation of appropriate skills, knowledge and attitude. It is the basis for transformation, industrialization and the attainment of global knowledge of the economy and also necessary for socio-economic development of a nation (Agi and Yellowe, 2013). Chemistry is the study of matter and its properties, the changes that matter undergoes and the energy associated with these changes (Ojokuku, Odetayo & Saluyigbe, 2012). It is the central science that rests on the foundation of Mathematics and Physics and in turn underlies the life science in Biology and Medicine. It is a core subject in all science related programmes such as Agriculture, Engineering, Medicine, Biochemistry, Microbiology, and Pharmacy and so on. Chemistry is a challenging and exciting subject as an academic discipline and ideas are to produce the chemicals from which all materials and consumer products are manufactured.

The socio-economic relevance of Chemistry education is also revealed in the objectives of Chemistry education in Nigeria. National Curriculum for Secondary School Science (1982) cited by Mohammed (2009) stated that Chemistry Curriculum is aimed at facilitating a transition from secondary school to tertiary level of Education in the use of scientific concepts and techniques acquired in Chemistry. Others include: Providing the students with the basic knowledge in chemical concepts and principles through efficient selection of content and sequence, showing chemistry and its relationship with other subjects and showing Chemistry and its links with industries, everyday life, hazards and benefits. Without missing word, Chemistry Education involves the understanding of how students learn chemistry, how best to teach Chemistry, and how to improve learning outcomes by changing teaching methods and appropriate training of Chemistry instructors (Taber, 2012). Chemistry education has been identified to be one of the major bedrocks for the transformation of a Nation's economy and usher in the desired technological advancement which is very much needed for sustainable development (Ayodele, 2018). Chemistry Education has a crucial role to play in helping to find answers to various human and socio-economic problems as well as making the society more scientifically literate.

Furthermore, Chemistry education is a vital instrument for socio-economic development of a nation. According to Emendu (2014), development is a socio-economic term. It is a kind of socio-cultural change in which new ideas are introduced into a social system in order to produce higher per capital incomes and higher standards of living through modern Science and Technology and improved social organisation. Development includes improvements in the material welfare of the people as well as the eradication of mass poverty and it correlates of illiteracy, diseases and short life-expectancy (Aniodoh, 2011). Chemistry education has its socio-economic relevance because the knowledge of Chemistry is useful in almost every aspect of human life. For instance, in Health care, drugs which are products of chemistry abound and are used for various purposes including prevention and treatment of various diseases.

Also, in the area of education, Chemistry education fosters scientific literacy. Chemical knowledge and the application of chemical principles and products are important in solving socio-economic problems. The knowledge of Chemistry is also needed in the supply of portable water as the water is chemically treated to kill germs, thus rendering it fit for human consumption and other domestic uses. Chemistry Education is also relevant in clothing, housing and energy supply. In other words, Chemistry is the basis of a modern energy supply,



agriculture, innovative materials, communication, biotechnological and pharmaceuticals (Burmeister, Rauch & Eilks, 2012).

More so, Chemistry Education also helps to tackle unemployment which has socio-economic impacts on the society. Unemployment is a real matter of concern as it can yield devastating impact on economic welfare, crime the erosion of human capital, misery and social instability (Kyei & Gyeke, 2011). Unemployment can result in some psychological and societal problems such as hopelessness, frustration, hostility and gradual drift of some visible unemployed youth into all manner of criminal behaviour (Shaki, 2022). Chemistry education entails putting science into business ventures that are successful. This is the major key to self-employment and employing others combining both entrepreneurial skills and technical skills. This ensures knowledge-driven business and setting up new ones so that science and knowledge play, a key role for the development of the society (Odia & Odia, 2013).

Theoretical Framework for the Study

Constructivism Theory

Constructivism theory was propounded by Jerome Bruner in 1966 (Olorode & Jimoh, 2016) in Akpan, Igwe, Mpamah & Okoro (2020). The theory states that people construct their own understanding and knowledge of the world, through experiencing things and by reflecting on those experiences. This theory was built upon the principles and the work of Jean Piaget's Theory of Cognitive Development, hence, sometimes Constructivism is referred to as "Cognitive Constructivism". Constructivism theory is based on two concepts: Learning and Instruction (Vygotsky, 1986; Dewey, 1997). Vygotsky and Vygotsky (1980) pointed that the theory believes that learners gain knowledge through experiences and build new knowledge on the existing ones. In this theory, it is believed that teachers' experience is essential in knowledge acquisition by the learners.

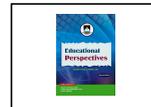
This explains that learning is an active process which is based on the assumption that knowledge is constructed by learners as they attempt to make sense out of their experiences. This point of view maintains that people actively construct new knowledge as they interact with their environment (Adesanya, 2009). In the classroom, the constructivist view of learning can be used to encourage students to use practical approaches to create more knowledge, reflect on and talk about what they are doing. The theory deemphasizes memorizing the conceptions and definitions of others but insists that learners create their own definition, meaning and understanding based on discovery (Bruner, 1974).

Application of Constructivism Theory to the Study

Constructivism postulates that learners' acquired awareness and knowledge by active involvement in the teaching/learning process. Learning is based on learners' exclusively participation in learning through discovery and creating of meaning and acquire knowledge. Vygotsky believed that life long process of development is dependent on social interaction and that social learning actually leads to cognitive development. In other words, all learning tasks (irrespective of the level of difficulty), can be performed by learners under adult guidance or with peer collaboration.

Statement of the Problem

In recent years, many developing countries, Nigeria inclusive, are faced with socio economic problems such as underemployment, youth unrest, unemployment and abject poverty among others. This has affected their economy adversely. The seeming high rate of unemployment



among youths, especially graduates has been a great concern to education stakeholders. The situation of unemployment in Nigeria is indeed at alarming rate. This may be that many graduates rely on white collar jobs rather than finding alternate means of been self-reliance. It seems that there is poor knowledge, awareness and practice of Chemistry education among graduates can go a long way in creating more socio economic problems in the society. This is because the diverse opportunities available in Chemistry education are not well utilized and this make graduates that supposed to be engaged to be jobless.

Previous studies focused on needs of Chemistry education to the society while others considered the relative relationship of knowledge, awareness and practice of Chemistry as a discipline with little attention on socio-economic aspects and Chemistry education. Thus, this study examined the knowledge, awareness and practice of undergraduates on the socio-economic relevance of Chemistry education to undergraduates in Oyo town, Nigeria.

Objectives of the Study

The main objective of the study is to investigate knowledge, awareness and practice of socio-economic relevance of chemistry education among undergraduates in Oyo town, Nigeria

Research Questions

The following research questions were raised for the purpose of this study:

1. What is the awareness of undergraduate Chemistry students on the socio-economic relevance of Chemistry Education?
2. What is the knowledge of undergraduate Chemistry students in the products and services that can be obtained through Chemistry Education?
3. In what way do undergraduate Chemistry Students practicalise what they learn through Chemistry Education?

Method

The research design adopted for the study was a descriptive survey design. The population for the study consist of all undergraduates in all universities in Oyo town in Oyo State. Out of the four universities in Oyo town, two universities were selected for the purpose of the research work namely: Emmanuel Alayande University of Education, Oyo and Ajayi Crowther University, Oyo. For the study, 80 students were used, thus, 40 students were selected using a simple random sampling technique from each of the two universities (Emmanuel Alayande University of Education and Atiba University in Oyo town, Oyo State).

A constructed and self- developed questionnaire tagged “Knowledge, Awareness and Practice of Undergraduates on the Socio Economic Relevance of Chemistry Education (KAPUSRCEQ)” was used to access information from the respondents. The questionnaire is made up of two sections. Section A focused on the personal data of each respondent while Section B elicited information on knowledge, awareness and practice of undergraduates on the Socio Economic Relevance of Chemistry Education. The questionnaire was validated by the experts in the field of Chemistry education. Reliability of the instrument was carried out using Test - retest method and value of 0. 74 was obtained. The questionnaire utilized a 4-point scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The instrument was administered by the researchers. A total of 80 copies of questionnaire



were distributed and all (100%) were retrieved. The data were analyzed using simple percentage analysis.

RESULTS

Demographic Analysis

Table 1: Frequency distribution of the respondents by sex

Sex	Frequency	Percentage
Male	52	65.00
Female	28	35.00
Total	80	100.00

Table 1 indicates the sex distribution of the respondents used for the study. It was found that 52 (65.00%) of the respondents were male while the remaining 28 (35.00%) were female. This shows that more female English teachers were selected more than their male counterparts.

Age	Frequency	Percentage
16- 20	11	8.80
21- 25	46	36.80
26-30	20	16.00
Above 30	03	2.40
Total	80	100.00

Table 2 displays the age distribution of the respondents used for the study. It was found that those within 16-20 years were 11(8.80%) respondents. Likewise, between 21-25 were 46 (36.80%). In addition, between 26 and 30 years were 20 (16.00 %) of the respondents. Also, age range of above 30 years was 03 (2.40%) respondents.

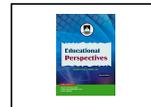
Table 3: Level Distribution of the respondents

Level	Frequency	Percentage
100	20	25.00
200	20	25.00
300	20	25.00
400	20	25.00
Total	80	100.00

Table 3 specifies the level distribution of the respondents used for the study. Equal distribution selection was used in the selection of respondents for this study. Twenty (25.00%) respondents were selected at each level.

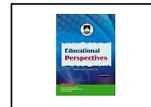
Answering of Research Question

Research Question 1: What is the awareness of undergraduate Chemistry students on the socio-economic relevance of Chemistry Education?


Table 4: Undergraduate Chemistry students' awareness of the socio-economic relevance of Chemistry education.

S/N (%)	ITEMS	SA (%)	A (%)	D (%)	SD
1	Chemistry is important in transforming wastes to wealth.	50 (62.50)	23 (28.75)	07 (8.75)	- (0.00)
2	Products from chemical companies such as polymers, coatings, pharmaceuticals and pesticides are useful in everyday life.	43 (53.75)	16 (20.00)	12 (15.00)	09 (11.25)
3	Chemistry education is indispensable in agricultural production.	62 (77.50)	05 (6.25)	10 (12.50)	03 (3.75)
4	Chemistry education is indispensable for food production for economic growth.	35(43.75)	41(51.25)	04 (5.00)	- (0.00)
5	Chemistry education can equip one to be self-reliant.	40 (50.00)	20 (25.00)	13 (16.25)	07 (8.75)
6	Chemistry entrepreneurship education can help chemistry graduates to be self-employed.	67 (83.75)	17 (21.25)	06 (7.50)	- (0.00)
7	The knowledge of Chemistry is useful in different economic sectors.	48 (60.00)	12 (15.00)	15 (18.75)	05 (6.25)
8	Chemistry education has plays a critical role in developing economic growth.	32 (40.00)	26 (32.50)	10 (12.50)	12 (15.00)
9	The Awareness of Chemistry education helps in improving the quality of life.	27 (33.75)	19 (23.75)	34 (42.50)	- (0.00)
10	Chemistry education helps in converting raw materials to products needed for everyday life.	41 (51.25)	11 (13.75)	20 (25.00)	08 (10.00)

From the table 4, undergraduate Chemistry students' awareness of the socio-economic relevance of Chemistry education is shown. That Chemistry is important in transforming wastes to wealth, 50(62.50%) respondents strongly agreed, 23(28.75%) respondents agreed while 07(8.75%) respondents disagreed with the motion. Also, on the item that products from chemical companies such as polymers, coatings, pharmaceuticals and pesticides are useful in everyday life, 43 (53.75%) strongly agreed. 16(20.00%) agreed, 12 (15.00%) respondents disagreed while 9(11.25%) strongly disagreed. 62 (77.50%) respondents strongly agreed, 5 (6.25%) respondents agreed, 10 (12.50%) respondents disagreed while 3 (3.75%) respondents strongly disagreed that Chemistry education is indispensable in agricultural production. On the item that says Chemistry education is indispensable for food production for economic growth, 35 (43.75%) respondents strongly agreed, 41(51.25%) respondents agreed while 4 (5.00%). respondents disagreed with the view. In addition, 67 (83.75%) respondents strongly agreed, 17 (21.25%) respondents agreed while 6 (7.50%) respondents disagreed that the Chemistry entrepreneurship education can help chemistry graduates to be self-employed. More so, 32(40.00%) respondents strongly agreed, 26 (32.50%) respondents agreed, 10 (12.50%) respondents disagreed while 12 (15.00%) strongly disagreed that Chemistry education has plays a critical role in developing economic growth. Likewise, on the view that Chemistry education helps in converting raw materials to products needed for everyday life, 41(51.25%) respondents strongly agreed, 11(13.75%) respondents agreed, 20 (25.00%) respondents disagreed while 8 (10.00%) respondents disagreed with the motion. This implies that Chemistry education enhances better economic growth and development.

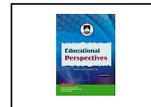


Research Question 2: What is the knowledge of undergraduate Chemistry students in the products and services that can be obtained through Chemistry education?

Table 5: Knowledge of undergraduate chemistry students on the products and services that can be obtained through Chemistry education

S/N	ITEMS	SA (%)	A (%)	D (%)	SD (%)
	I have knowledge that:				
1.	Preparation of indicators from flower extracts	30 (37.50)	13(16.25)	4 (58.75)	- (0.00)
2.	Production of soaps and detergent from local materials	41 (51.25)	24(0.00)	13 (16.25)	02(2.5)
3.	Production of margarine and butter	35 (43.75)	15 (18.75)	20 (25.00)	10(12.50)
4.	Manufacture of perfume and pomade	27(33.75)	24 (30.00)	16 (20.00)	14(17.50)
5.	Production of paints from chemicals	12(15.00)	45(56.25)	23 (28.75)	- (0.00)
6.	Dyes from natural plants	43 (53.75)	22 (27.50)	11 (13.75)	03 (3.75)
7.	Production of acids for charging batteries	24(30.00)	26 (32.50)	16 (20.00)	14 (17.50)
8.	Production of shoes polishes, palm kernel oil and vegetable oil	30 (37.50)	34 (42.50)	16 (20.00)	-(0.00)
9.	Production of bread and biscuits	52 (65.00)	13 (16.25)	05(6.25)	10(12.50)
10.	Production of insecticides, antiseptics and disinfectants.	40 (50.00)	22 (27.50)	18(22.50)	-(0.00)

Table 5 displays the knowledge of undergraduate chemistry students on the products and services that can be obtained through chemistry education. On the view that Chemistry education enhances the preparation of indicators from flower extracts, 30 (37.50%) respondents strongly agreed, 13(16.25%) respondents agreed while 47(58.75%) respondent disagreed with the motion. Also, on the item that production of soaps and detergent from local materials, 41 (51.25%) respondents strongly agreed, 24(30.00%) agreed, 13. (16.25%) disagreed while 2(2.50m,%) strongly disagreed. 12(15.00%) respondents strongly agreed, 45(56.50%) respondents agreed while 23 (28.75%) respondents disagreed that production of paints from chemicals. On the item that says dyes from natural plants, 43(53.75%) respondents strongly agreed, 22(27.50%) respondents agreed, 11 (13.75%) respondents disagreed while 3 (3.75%). respondents strongly disagreed with the view. In addition, 30 (37.50%) respondents strongly agreed, 34 (42.50%) respondents agreed while 16 (20.00%) respondents disagreed that the production of shoes polishes, palm kernel oil and egetable oil. In the same vein, 30 (37.50%) respondents strongly agreed, 34 (42.50%) respondents agreed, 16 (20.00%) respondents disagreed that production of shoes polishes, palm kernel oil and vegetable oil. That knowledge of undergraduate chemistry students can be obtained through chemistry education in the production of insecticides, antiseptics and disinfectants. Also, 40(50.00%) respondents strongly agreed, 22 (27.50%) respondents agreed, 18 (22.50%) respondents disagreed that production of insecticides, antiseptics and disinfectants. This implies that Chemistry education knowledge among undergraduate Chemistry students has promote innovation.



Research Question 3: Undergraduate Chemistry students' Practice of skills acquired through Chemistry education.

Table 6: Practice of Undergraduates on the socio-economic relevance of Chemistry

S/N	ITEMS	SA (%)	A (%)	SD (%)	D (%)
	I can produce or manufacture the following through Chemistry Education:				
1.	Soaps and Detergent	70 (87.50)	10 (12.50)	- (0.00)	- (0.00)
2.	Candles	50 (62.50)	20 (25.00)	02 (2.50)	08 (10.00)
3.	Pomades and Creams	40 (50.00)	30 (27.50)	10(12.50)	(0.00)
4.	Polish	60 (75.000)	11(13.75)	09(11.25)	(0.00)
5.	Dyes	75 (93.75)	5 (6.25)	- (0.00)	-(0.00)
6.	Perfumes	50(62.50)	21 (26.25)	04 (5.00)	05 (6.25)
7.	Paints	20 (25.00)	40 (50.00)	13 (16.25)	07(8.75)
8.	Bleaching powder (Cacl ₂)	30 (37.50)	21(26.25)	26 (32.50)	03 (3.75)
9.	Polythene	60 (55.50)	15 (18.75)	5 (6.25)	(0.00)
10.	Asbestos	45 (56.25)	23 (28.75)	2 (2.50)	-(0.00)

From the finding, it was found that practice of undergraduates on the socio-economic relevance of Chemistry was very significant. Majority submitted that they can produce or manufacture the following products through Chemistry education. All the respondents, 80(100.00%) strongly agreed on soaps and detergent. Also, 70 (77.50%) respondents strongly agreed on candles and pomades and creams making while 10 (12.50%) respondents likewise. On polish manufacturing, 71 (88.75%) were positive while 9 (11.25%) respondents were not in support. For dyes, 75(93.75%) agreed. 71 (88.75%) respondents agreed on perfumes and 60 (75.00%) respondents on paints. In addition, 51 (63.75%) respondents strongly agreed on bleaching powder (Cacl₂). Likewise, 75(93.51.25%) respondents strongly agreed on polythene while 68 (13.75%) respondents submitted on asbestos. This implies that practice of undergraduates on the socio-economic relevance of Chemistry was very significant to their self-employment which assist in general economy expansion.

Discussion of Findings

From the findings, it was found that low awareness of Chemistry education affect the understanding of how students learn Chemistry and improve learning outcomes by changing teaching methods and appropriate training of Chemistry into practical that would be beneficial. This is in line with Taber (2012) that Chemistry education has been identified to be one of the major bedrocks for the transformation of a Nation's economy and usher in the desired technological advancement which is very much needed for sustainable development. Also, Ayodele (2018) who pointed that Chemistry education has a crucial role to play in helping to find answers to various human and socio-economic problems as well as making the society more scientifically literate.

Furthermore, Chemistry education has its socio-economic relevance because the knowledge of Chemistry is useful in almost every aspect of human life in Health care, drugs which are products of chemistry abound and are used for various purposes including prevention and treatment of various diseases. According to Emendu,(2014), development is a socio-economic term. It is a kind of socio-cultural change in which new ideas are introduced into a



social system in order to produce higher per capital incomes and higher standards of living through modern Science and Technology and improved social organization.).

Also, in the area of practice of Chemistry education, it was found that Chemistry education fosters the application of chemical principles and products are important in solving socio-economic problems. The knowledge of Chemistry is also needed in the supply of portable water as the water is chemically treated to kill germs, thus rendering it fit for human consumption and other domestic uses. This is in line with the position of Burmeister, Rauch and Eilks (2012) that Chemistry Education is relevant in clothing, housing and energy supply. In other words, Chemistry is the basis of a modern energy supply, agriculture, innovative materials, communication, biotechnological and pharmaceuticals

Theoretical Framework for the Study

Constructivism Theory

Constructivism theory was propounded by Jerome Bruner in 1966 (Olorode & Jimoh, 2016) in Akpan, Igwe, Mpamah & Okoro (2020). The theory states that people construct their own understanding and knowledge of the world, through experiencing things and by reflecting on those experiences. This theory was built upon the principles and the work of Jean Piaget's Theory of Cognitive Development, hence, sometimes Constructivism is referred to as "Cognitive Constructivism". Constructivism theory is based on two concepts: Learning and Instruction (Vygotsky, 1986; Dewey, 1997). Vygotsky and Vygotsky (1980) pointed that the theory believes that learners gain knowledge through experiences and build new knowledge on the existing ones. In this theory, it is believed that teachers' experience is essential in knowledge acquisition by the learners.

Theoretical Implications to the Study

This theory explains that learning is an active process which is based on the assumption that knowledge is constructed by learners as they attempt to make sense out of their experiences. This point of view maintains that people actively construct new knowledge as they interact with their environment (Adesanya, 2009). In the classroom, the constructivist view of learning can be used to encourage students to use practical approaches to create more knowledge, reflect on and talk about what they are doing. The theory deemphasizes memorizing the conceptions and definitions of others but insists that learners create their own definition, meaning and understanding based on discovery (Bruner, 1974).

Conclusion

Chemistry education is needed for the development of technological emancipation and industrial expansion. It has the capacity to contribute substantially to increasing the wellbeing and economic growth of a nation. Application of Chemistry Education is useful in almost every aspects of human life ranging from health care, energy supply, agriculture, communication, biotechnology and so on. Chemistry education has been identified as a strong tool to overcoming socio economic challenges through skill acquisition, entrepreneurship and innovations. Science and technology education, especially Chemistry education if fully implemented, will boost production and accelerate economic growth of Nigeria, provide manpower required in industries and reduce unemployment there by reducing the effect of the challenges of poor economy.



Recommendations

Following the roles of Chemistry education in the socio-economic growth of a nation, the following recommendations were made:

1. Chemistry education should be made compulsory to all students in secondary and tertiary institution irrespective of the discipline.
2. Government should provide modern laboratories that will assist in the teaching and learning of practical skills in Chemistry Education.
3. Financial assistance should be provided at the Federal, State, Local government levels to enhance self-entrepreneurship and self-reliance.
4. The government both at the Federal and State level should promote regional and international symposium specifically targeted towards achieving the goals of building self-reliant generation which in turn will enhance socio-economic growth.



References

- Adesanya, L. A. (2009). Education and learner autonomy. In U. M. O. Ivowi, K. Nwifo, C. Nwagbara, J. Ukwungwu, I. E. Emah, G. Uya (Eds.), *Curriculum Theory and Practice* pp 123-130. Curriculum Organisation of Nigeria: Top Goddy Nig. Ltd.
- Agi U. K and Yellwe N. A (2013). Management strategies for Regenerating Secondary Education for National Development and Self-Reliance. *Journal of Teachers Perspective (JOTEP)*.7(2).Association of Nigerian Teachers (ASSONT) Calabar.
- Akpan, V. I. Igwe, U. A. Mpamah, I. B. I. & Okoro, C. O. (2020).Social Constructivism: Implications on Teaching and Learning.*British Journal of Education* 8 (8), pp.49-56, September 2020 Published by ECRTD- UK. Print ISSN: ISSN 2054-6351: Online ISSN: ISSN 2054-636X
- Ayodele, O. D. (2017). Researching Secondary School Chemistry Education for Sustainable development in Nigeria developing economy. *African Journal of Chemistry Education*
- Bruner, J. (1974). *Toward a theory of instruction*. Cambridge: Harvard University Press.
- Burneister, M., Rauchi, F. & Eilks, I. (2012). Education for Sustainable Development ESD and Chemistry Education. *Chemistry Education Research and Practice* 13: 59-68.
- Emendu, N. B (2014) .The Role of Chemistry Education in National Development. *International Journal of Engineering and Science*, 3, 12-17.
- Mohammed. M. M. (2009). Quality Chemistry education for a sustainable development in Nigeria. Unpublished paper presented at the 1st National conference organised by school of education. Isah Kaita College of education, Dutsinma,
- Odia, J. & Odia, A. (2013). Developing Entrepreneurial Skills and Transforming Challenges into Opportunities in Nigeria. *Journal of Education and Social Research*, 3(3), 289-298
- Ojokuku, R. M., Odetayo T. A., Saluyigbe, A. S. (2012). Impact of Leadership style in Organization Performance. A Case Study of Nigerian Banks. *American Journal of Business and Management*. 1,4
- Olorode, J. J. & Jimoh, A. G. (2016). Effectiveness of guided discovery learning strategy and gender sensitivity on students' academic achievement in financial accounting in Colleges of Education. *International Journal of Academic Research in Education and Review*. 4(6), 182-189. DOI: 10.14662/IJARER2016.02. Retrieved from <https://www.thirteen.org/edonline/concept2class/constructivism>
- Taber K. S. (2012). Recognising Quality in Reports of Chemistry Education Research and Practice. *Chemistry Education Research and Practice* 13 (1), 4-7
- Vygotsky, L. (1986). *Constructivism Theory. Thought and Language*. MIT Press