

EFFECTS OF ETHNO-CHEMISTRY-BASED CURRICULUM DELIVERY ON STUDENTS' INTEREST IN CHEMISTRY IN OBOLLO-AFOR EDUCATION ZONE OF ENUGU STATE

Anthonia N. Ugwu PhD

Dept of Science Education

Michael Okpara University of Agriculture, Umudike.

Abstract

This study determined the effectiveness of incorporating ethno-chemistry practices into curriculum delivery on students' interest in chemistry. It adopted a quasi-experimental non-equivalent pre-test-post-test control group design. Three research questions and three hypotheses formulated guided the study. The population of the study consisted of 1,329 senior secondary two (SSII) chemistry students in Obollo-Afor education zone of Enugu state in 2016/2017 academic session. Using stratified simple random sampling technique, 137 students from four co-educational schools in the study area were selected. Chemistry interest scale (CIS) was used for data collection. This was developed by the researcher and validated by experts in test and measurement and chemistry educators from Michael Okpara University of Agriculture, Umudike. The reliability CIS was established as 0.79 using cronbachalpha technique. The research questions were answered using mean and standard deviations while hypotheses were tested at 0.05 level of significance using ANCOVA. The findings of the study revealed that students' interest in chemistry improved significantly with the incorporation of ethno-chemistry practices into curriculum delivery. The findings also revealed that female students' interest improved better than their male counterparts with incorporation of ethno-chemistry practices. It was recommended among other things that curriculum planners should endeavour to enrich curriculum contents with ethno-chemistry practices form different localities in subsequent curriculum review to help the young ones appreciate and sustain their culture for future.

Introduction

The concept 'curriculum' as a field of study is central to the attainment of educational goals of the nation and as such its delivery process to learners becomes an issue of great concern to stakeholders in education. The essence of designing a curriculum in science education is to promote positive learning

outcomes and give teachers the “road map” to effective curriculum delivery (Opara, 2008). Curriculum delivery is the implementation stage in the curriculum process. It is a critical stage because it is at this stage that the teacher who is the major implementer through varieties of teaching methods and strategies, activities and experiences imparts the curriculum contents (knowledge, skills and attitudes) to the learner. It is at this delivery stage of the curriculum that the learners are actually engaged with the planned learning opportunities for their change in the right direction all towards the attainment of the educational goals of the nation. One of the major factors of consideration in the implementation stage of the curriculum is teaching methods, strategies, techniques and approaches employed in the process.

Teaching methods and strategies are among the chief determinants of achievement and interest in science. Aniodoh and Eze (2014) posited that teaching techniques and instructional strategies used in chemistry classrooms have been described as inappropriate and uninspiring. It has been revealed that the poor achievement in chemistry is blamed on poor teaching strategies adopted by chemistry teachers over the years (Oloruntegbe & Oduntunji, cited in Giginna & Nweze, 2014). Methods and strategies of teaching adopted by teachers significantly influence students’ understanding, interest and achievement in the learning process especially in science subject like chemistry. Through application of varieties of teaching strategies, a great teacher does not only inspire the students but also helps them to learn meaningfully. In the field of sciences like chemistry, students should be encouraged to learn meaningfully so as to be able to apply the knowledge in solution of life problems.

It has been observed that for learning to be meaningful and effective in chemistry classroom, the teacher should be able to select an appropriate teaching strategy that will be able to stimulate the interest of the learners and get learners actively engaged in the process of learning (Ezeh, cited in Aniodoh & Eze, 2014). The theory of meaningful learning propounded by David Ausubel around (1963) has contributed immensely towards the teaching and learning of science today. According to Ausubel cited in Ugwu and Diovu, (2016), meaningful learning occurs when there is interaction between the learners’ appropriate elements in the knowledge that already exists and the new materials to be learnt. Suffix it to say that new knowledge to be acquired must relate to the learners frame of reference in existence. This frame of reference most times are found in the indigenous knowledge and practices acquired by the learner through his experiences and interactions with the environment. Such practices with science undertone are referred to as ethno

science and by extension ethno chemistry when it has to do with chemical practices.

The term 'ethno' is a very broad term that refers to the social-cultural context and therefore includes language, jargon, and codes of behaviour, myths and symbols (Rosa and Orey cited in Singh & Chibuye 2016). According to Rosa and Orey, ethno-chemistry is all about member of a group within a cultural environment identified by their cultural traditions, myths and specific ways to reason and to infer. When attached to chemistry, ethno chemistry is described as the various chemistry related cultural land community practices (Singh & Chibuye, 2016). It is described as the chemical practices of identifiable cultural groups and is studied as chemical ideas found in the culture, they added. Odo (2013) also defined ethno chemistry as a unique system of indigenous knowledge about matter, its characteristics, interactions with other forms of matter and application articulated with a particular culture.

Indigenous peoples traditional education processes were carefully constructed around observing natural processes, adapting modes of survival, obtaining sustenance from plants and animal world using natural materials to make their tools and implements (Barhardt & Kawigley cited in Ugwu & Diovu, 2016). According to them, the indigenous views of the world and approaches to education has been brought into jeopardy with the spread of western societal structures and institutionalized forms of cultural transmission. In the same vein, Odo (2013) opined that the native knowledge of traditional societies including Nigeria has obviously been disdainfully attended to as inferior, retrogressive and backward in relation to the knowledge from western civilization. This bastardizes their culture and consequently affects the development of the community of the indigenous people.

Community development according to Hillman cited in Aminu, (2012) is the method of helping local communities to become aware of their resources in such a way as to satisfy some of their needs, and in so doing, acquire the attitude, experience and cooperative skills for repeating this process using their own initiatives. But with the neglect of these indigenous knowledge and practices, community development tends to be hampered. Besides, Ugwu and Diovu (2016) submitted that the abandonment of the indigenous knowledge and practices of the society in science for academic ways of teaching and learning makes the science of chemistry abstract. Therefore, incorporating the indigenous knowledge and practices (ethno-chemistry) in the delivery of chemistry curriculum content as a teaching strategy may enhance the understanding of chemistry concepts.

The science of chemistry is very essential and central to the study of many science disciplines like medicines pharmacy, biochemistry, and engineering to mention but a few. Chemistry curricula incorporate many abstract concepts, which are central to further learning in both chemistry and other sciences (Taber, 2002). The knowledge and skills in this central science is utilized in almost all the sectors of the economy (Singh and Chibuye, 2016). The fact that chemistry is full of life and life is full of chemistry cannot be underestimated (Achimugu, 2009). Most of our daily activities are chemistry. It is the science of everyday life, for instance the daily brushing of teeth, bathing and washing with soap and detergents respectively involves chemistry. Consequently, Umar cited in Danjuma (2009) opined that the study of chemistry is vital to mankind because it will be difficult to imagine life without chemistry. Unfortunately, it has been observed that students lack interesting the subject possibly due to its abstract nature. This lack of interest is confirmed by the number of students that drop chemistry at the end of senior secondary one (SS1) (Imo cited in Ezeliora, 1999). Agu in Njoku (2003) submitted that going by the poorest result achieved by students of chemistry at O' level, it is adduced that students lack interest in chemistry since students' interest significantly correlates with their academic achievements in school subject; it has significant influence on their learning outcome. Interest too determines the zeal with which students study and solve their academic problems. Hence, the application of teaching strategies that can enhance students' interest and improve understanding becomes imperative.

Some researchers have conducted some studies on the effects of ethno science on achievement and interest of students in learning. Okwara & Upu (2017) worked on effects of ethno-science instructional approach on students' achievement and interest in upper basic science and technology in Benue State. Their findings revealed increase in both achievement and interest with ethno-science instructional approach. Also Abonyi (2002) worked on effects of ethno-science based instructional package on students' interest in science and reported a positive effect of the package on students' interest in science. According to Singh and Chibuye (2016), who worked on effects of ethno-chemistry practices on secondary school students' attitude towards chemistry, the findings were still in favour of ethno-chemistry and they added that "the inclusion of knowledge related to ethno-chemistry practices may instil a sense of ownership about the concept and improve students' attitude in chemistry". Still on the efficacy of ethno-chemistry practices, Said-Ador (2017), revealed that integration of ethno-chemistry practices into the curriculum may in addition to helping in preservation and appreciation towards the quality of the students' cultural heritage, provide students'

meaningful learning. Hence, the investigation into the effectiveness of ethno-chemistry-based curriculum delivery on students' interest in chemistry as the focal interest of this study.

In spite of the immeasurable intrinsic and utility values of chemistry in all spheres of human activities, its importance in the social and economic sphere of any nation, students lack interest in the subject and consequently achieve low in chemistry examinations. This lack of interest which have resulted to poor achievement is blamed on inappropriate and uninspiring teaching techniques used by teachers for years (Aniodoh & Eze, 2014). Considering the importance of the science of chemistry in life generally and in the social and economic life of a nation, it becomes pertinent to look for teaching strategies that should enhance students' interest, understanding and achievement in the subject. It is expected that in the delivery of chemistry curriculum content, teachers should always employ appropriate teaching methods and strategies among other means not only to enhance understanding and achievement but also to foster interest in the subject.

The following research questions and hypotheses guided the study:

1. What is the mean interest scores of chemistry students when ethno-chemistry practices is incorporated into curriculum delivery and when they are not?
2. What is the mean interest scores of male and female chemistry students when ethno-chemistry practices is incorporated into curriculum delivery?
 1. There is no significant difference in the mean interest scores of students taught chemistry using ethno-chemistry based curriculum delivery strategy and those taught using the conventional curriculum delivery strategy
 2. There is no significant difference in the mean interest scores of male and female students taught chemistry using ethno-chemistry based curriculum delivery strategy.
 3. There is no significant interaction effect of gender and instructional strategies on students' interest in chemistry?

The null hypotheses were tested at 0.05 level of significance

Method

The study adopted a quasi-experimental research design. Specifically, pre-test post-test non-equivalent control group design was employed. This design is considered appropriate as intact classes were used and according to Nworgu (2006), it helps to control extraneous variable. Out of 1,329 SS II chemistry students in the 54 senior secondary schools in Obollo-Afor education zone, 137 students made up of 77 males and 60 females from four

intact classes in 2016/ 2017 academic session formed the sample size. This was done using stratified random sampling technique. Using simple random sampling technique, two intact classes were assigned to experimental and control groups.

The chemistry teachers in the sampled schools were used as research assistants and the teachers for the experimental groups were trained on how to incorporate ethno-chemistry practices into the lesson using the lesson plans developed by the researcher but without incorporation of ethno chemistry practices for the control groups. The validated instrument used for data collection was chemistry interest scale developed by the researcher and was given face validation.

All the students were both pre and post tested with CIS. The two groups were taught separation techniques, change of state, acids, bases and salt and neutralization reactions for 12 weeks. Data collected were analysed using mean and standard deviation for research questions and analysis of covariance (ANCOVA) for testing the hypotheses at 0.05 level of significance.

Results

Table 1: Mean and standard deviation of students' scores in both experimental and control groups

Group		No. of Students	Mean Interest	Mean Interest Gain	Standard Deviation
Experimental	Pre-test	62	38.47	18.40	6.04
	Post-test	62	56.87		6.62
Control	Pre-test	75	41.13	6.48	7.54
	post-test	75	48.61		5.51

Table 1 shows that the mean interest gain for the experimental group is 18.40 while that of the control group is 6.48 indicating the superiority of the experimental group over the control group in chemistry interest scale.

Table 2: Mean and Standard Deviation for the experimental and control groups across gender

Group	Gender	No. of students	Mean (\bar{x})	Standard Dev.	Mean Interest Gain	
Experimental	Male	Pre-interest	37	50.03	6.056	14.43
		Post-interest	26	64.46	8.664	
	Female	Pre-interest	22	31.73	7.304	17.86
		Post-interest	22	55.59	8.233	

Control	Male	Pre-interest	33	33.64	7.713	17.39
		Post-interest	33	52.03	8.512	
	Female	Pre-interest	30	34.13	6.329	15.17
		Post-interest	30	49.30	5.658	

Table 2 shows the mean interest scores of male and female students in both the experimental and control groups. The mean interest gain for the male and female students in the experimental group are 20.90 and 17.86 respectively, while that of the control group are 17.39 and 15.17 for males and females respectively.

Table 3: Analysis of Covariance (ANCOVA) for differences between the mean interest scores of students in the experimental group and those in the control group

Sources	Sum of squares	<i>df</i>	Mean square	<i>f</i>	Sign <i>f</i>
Corrected model	2577.433 ^a	4	4644.358	18.261	0.000
Intercept	8939.276	1	8939.276	253.338	0.000
Pre-test	230.736	1	230.736	6.539	.012
Method	1364.548	1	1364.548	38.671	0.000
Gender	.022	1	.022	.001	0.980
Method*Gender	27.808	1	27.808	.788	0.376
Error	4657.750	132	35.286		
Total	382692.000	137			
Corrected Total	7235.182	136			

Table 3 revealed that *f* value of 38.671 is significant at 0.000 for methods at 1 and 136 degrees of freedom (*df*), because 0.000 is less than 0.05 significant level set for the hypothesis. The null hypothesis is therefore not accepted. There is significant difference in the mean interest scores of those taught chemistry with incorporation of ethno-chemistry practices and those taught with conventional method.

The findings also revealed a no significant difference for gender at 1 and 136 degrees of freedom (*df*), since *f* value of 0.001 is not significant at 0.980 for gender at 1 and 136 degree of freedom (*df*). This is because 0.980 is more than 0.05 significant level earlier set for the hypothesis, therefore the hypothesis is upheld. That is, there is no significant difference in the mean interest scores of male and female chemistry students taught with incorporation of ethno-chemistry practices.

The findings also revealed that f value of (0.788) is not significant at 0.376 for the interaction between methods and gender at 1 and 136 degrees of freedom (df) since 0.376 is more than .05 significant level set for the hypothesis. Hence, the null hypothesis is upheld and so there is no significant interaction effect of teaching strategies and students' gender on the mean interest scores of chemistry students.

Discussion

The results of the study revealed that the treatment group obtained a higher mean interest score than their control group counterpart due to incorporation of ethno-chemistry practices into curriculum delivery. This was confirmed by hypothesis testing. The superiority of the treatment group over the control group may not be unconnected with the nature of ethno-chemistry practices. It is culture-based.

The findings of this study is in agreement with the findings of Ugwu and Diovu (2015) who reported a positive change in the students' achievement in chemistry due to incorporation of indigenous knowledge and practices in chemistry lessons. It also agrees with Singh and Chibuye (2016) who reported a positive change in students' attitude to chemistry due to ethno chemistry practices.

The finding is equally in agreement with Abonyi, (2002) who reported that ethno-science based instructional package is effective in fostering interest in students in sciences. The superiority of ethno-chemistry based curriculum delivery strategy over the conventional curriculum delivery strategy may be due to cultural background of the ethno-chemistry practices. It incorporates the ideas from the child's environment. According to Abonyi (2002), ethno science based instruction uses ideas, concepts, objects and materials from the child's environment which tends to make learning more interesting and clearer.

In the case of gender, the finding of this study revealed that male students has a higher mean interest score in the experimental group than their female counterparts in CIS although the difference was not significant. These were further confirmed by one ANCOVA result in table 4 which revealed that gender was not a significant factor on students' mean interest scores when taught with ethno-chemistry –based curriculum delivery strategy. The result of this study is in line with the views of previous researchers like, (Nwosu, 2001 and Nwagbo, 2011) who found out that gender had no significant influence on acquisition of science process skills among secondary school biology students. It also agrees with Mari, (2002) who submitted that there was no significant difference in the performance of male and female students in all the schemata

except in the schemata of correlation reasoning in which males performed better than the females. The findings also revealed that there was no interaction between teaching methods and gender of the subjects to influence students' mean interest scores in chemistry. This was further confirmed by ANCOVA result in table 4 which showed that the interaction effect between teaching methods and gender of the students were not significant, implying that gender did not combine with teaching methods to affect the students' mean interest scores in chemistry. This result is in agreement with the findings of Mari (2002), Ibe (2004) and Nwagbo, 2011 who found no significant interaction between instructional methods and gender on performance and, acquisition of science process skills respectively.

Conclusion

From the results of the study, the following conclusions were drawn:

1. Ethno-chemistry curriculum delivery is more effective than the conventional curriculum delivery in enhancing students' interest in chemistry as witnessed in the hypothesis testing which showed statistical significant difference in the mean interest scores of students.
2. There is no statistically significant difference in the mean interest scores of male and female students using ethno-chemistry curriculum delivery implying that gender has no effect on students' interest even with the use of ethno-chemistry curriculum delivery.
3. Although ethno-chemistry curriculum delivery is superior to conventional curriculum delivery in fostering interest in chemistry in both males and females, there is no statistically significant interaction between gender and instructional approach on students' interest in chemistry.

Recommendations

Based on the findings of this study, the researcher made the following recommendations:

- (1) Curriculum planners should work towards enriching the contents of the curriculum with ethno-chemistry practices from different localities in their curriculum review so as to help the young ones appreciate and sustain their culture for the future.
- (2) Chemistry teachers should endeavour on their own to inculcate ethno-chemistry practices in the locality in their chemistry teachings as advanced organisers to help students understand the concepts better and develop interest and achieve high in the subject.

References

- Abonyi, S. O. (2002). Effects of an ethno-science-based instructional package on students' interest in science. *Journal of Science Teachers' Association of Nigeria (STAN)*, 37 (1 & 2), 60 – 68.
- Aminu, A .A. (2012). Youth and community development in Nigeria. *Journal of Educational and Social Research*.3(7), 27 – 30, Retrieved from Doi: k10.5901/
- Aniodoh, H.C.O and Eze, G.N. (2014). Achieving effectiveness in secondary school chemistry classrooms using constructivist approach: A case study of physical and chemical changes. *The 55th Annual Conference Proceedings of STAN*,247 – 252.
- Ezeliora,B. (1999). A comparative analysis of the effect of improvised and standard models and graphics on students' achievement and interest in chemistry. *Journal of Science Teachers' Association of Nigeria (STAN)* 34 (1 & 2) 47 – 56.
- Giginna, L.I. (2014). Effective teaching of carbon(IV). Oxide using locally available resources. In G.O. Ojokwu, E.O. Amachi, M.U. Olayiwola, H.I. Yero. & N.A. Udchukwu (Eds), *Teaching Carbon and its compounds, hydrocarbons & crude Oil. Proceedings of the Science Teachers' Association of Nigeria, Chemistry panel series 10 (32-35). Machin Multimedia Designers, Zaria.*
- Ibe, E. (2004). Effects of guided discovery, demonstration and conventional methods of teaching science on acquisition of science process skills among senior secondary school students. An Unpublished Thesis, University of Nigeria Nsukka.
- Ivowi, U.M.O. (2009). Curriculum and the total person Nigeria *Journal of curriculum studies*. (16), 1-13.
- Lambert, L. (2003). From 'Savages' to scientists: Mainstream science moves towards recognising traditional knowledge. Tribal College. *Journal of American Indian Higher Education* 15(1): 11- 12
- Mari, J. S. (2002). Gender related differences in acquisition of formal schemata: pedagogic implication of teaching chemistry using process-based approach. *Journal of Science Teachers' Association of Nigeria (STAN)* 37(1&2), 76 - 81.
- Njoku, Z. C. (2003). Development and preliminary validation of a scale for the assessment students' interest in 'O' level practical chemistry activities. *Journal of Science Teachers' Association of Nigeria (STAN)*,64-70.
- Nwagbo, C, R. (2011). Effects of biology practical activities on process skill acquisition. *Journal of Science Teachers' Association of Nigeria (STAN)*, 46(1) 58-70.

- Nwosu, A. A. (2001). Gender and acquisition of science process skills among senior secondary school students: implication for science teaching. The 42nd Annual Conference Proceedings of Science Teachers' Association of Nigeria (STAN), 206 - 209.
- Odo, E.E (2013). Integration of ethno-chemistry curriculum in Nigeria: Option for sustainable development. The 54th Annual Conference Proceedings of STAN, 260- 267.
- Okwara, K. O. & Upu, F. T. (2017). Effects of ethno-science instructional approach on students' achievement and interest in upper basic science and technology in Benue State. *International Journal of Scientific Research in Education*, 10 (1) 69 – 78.
- Opara, M.F (2008). Facilitating effective curriculum delivery through self-regulation: Implication for students' achievement in chemistry. The 49th Annual Conference Proceedings of Science Teachers Association of Nigeria (STAN), 129- 135.
- Said –Ador, N.K. (2017). Ethno-chemistry of Maguindanaons on the usage of household chemicals. Implication to chemistry education. *Journal of Social Sciences (COES & RJ-JSS)*, 6(2), 8-26.
- Singh, I. & Chibuye, B. (2016). Effects of ethno-chemistry practices on secondary school students' attitude towards chemistry. *Journal of Education and Practice* 7 (17), 44-56.
- Taber, K. S. (2002). Alternative conceptions in chemistry: prevention, Diagnosis.-
- Ugwu, A.N & Diovu, C.I. (2016). Integration of indigenous knowledge and practices into chemistry teaching and students' academic achievement. *International Journal of Academic Research and Reflection* 4(4), 22-3