Special Issue
Journal of General Studies ESUT ISSN: 1115-6767, E-ISSN: 2971-6241 **Vol. 7 No. 2, 2025**

AWARENESS OF ETHNO-BASED PRACTICES IN TEACHING CHEMISTRY IN ENUGU EDUCATION ZONE, ENUGU STATE

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Abstract
This study investigated the awareness of ethno-based practice in teaching chemical reactions and particulate nature of matter in Chemistry. The teaching and learning of chemistry has poised a lot of challenges to both teachers and students due to its Eurocentric nature. Effort to tackle some of these challenges necessitated the purpose for this study. To find a solution to the gap created by location (urban and rural) of the public secondary school chemistry teachers in the discourse under investigation, two research questions and two hypotheses were formulated to guide this study. The researcher adopted cross sectional survey research design for the study while the sample size of 72 chemistry teachers was used. A 12 item structured questionnaire was used for data collection. The instrument was validated and also tested for reliability using Cronbach Alpha reliability estimate. The reliability coefficient of 0.85 was obtained. Mean and Standard Deviation were used to answer the research question while t-test statistics was used to test the null hypotheses at 0.05 level of significance. The result of the study revealed that urban chemistry teachers agreed to a high level of awareness of ethno-based chemistry practice in teaching chemical reactions and particulate nature of matter when compared to their rural counterparts. Based on this finding, it was recommended that government should sensitize and supervise the chemistry teachers to enforce the utilization of ethno-based practice in teaching chemistry to ensure that students learn chemistry from the activities practiced in their immediate environment or homes.

Keywords: Awareness, Ethno-based, Practice, Chemistry, Education

Introduction
Scientific literacy is a necessary ingredient that is required in the development of any nation. Scientific knowledge encompasses written, numerical and digital literacy as they pertain to understanding science, its methodology, observations and theories ((Kathleen, 2018). If any nation must develop, the study of science should be given adequate attention in the various levels of her education. Nigeria as a developing nation appears to have been prepared to resolve the issue of developments in science through her policy on Education. The policy provides for a 60:40 admission ratio in the tertiary institutions in favour of science (Iyke-ugwueze, 2022). This has not been achieved due to the poor performance of students in science.

Chemistry plays vital roles in Nigerian science education programme as it is one of the subjects that prepare students at the Senior Secondary level for the study of core science and science-related courses at the tertiary education level. Despite the importance of Chemistry, the persistent failure of the Nigerian students in the subject

has remained a major threat to its learning. Not much learning, understanding, retention and application of what is learnt take place without exploring the learners' culture and environment. Students taught using ethnochemistry approach had significantly higher mean achievement scores than those taught using discussion method (Oluwatosin, Edoga and Ogbu, 2017). It is important to determine the teachers' awareness of ethno-based practice in teaching chemistry because this will enhance the understanding of concepts that are termed foreign in teaching and learning.

In recent times, researchers seek ways to make science to be more meaningful and useful to learners in solving some of their environmental problems (Chukwu & Ijere, 2022). This necessitated the use of ethno-based chemistry practice which has to do with using materials in the environment to teach students the basic concepts in chemistry. It is an unfortunate event that even at this 21st century, science is still viewed as a foreign subject that is different from our environment. According to Ajayi, Achor & Agogo (2017), ethno method of teaching involves situating learning and problem solving in real life context, where the environment is very rich in information with physical materials that serve as a source of manipulative and interactive processes, Students are made to link the past to the present so as to build the future. This brought about subsumption theory of meaningful learning which was postulated by Ausubel (1953).

According to Ausubel, meaningful learning occurs when new information is linked to the existing relevant information or concept. The major idea of this theory is that learning occurs through the assimilation of new concept/information gathered from the environment by the learner through activities, into the already existing prior knowledge. This implies that the basis of teaching is to interact with the environment, picking up perceptions that are subsumed into what the learner already knows. This has a close relationship to the ethno-based chemistry practice in teaching chemical reactions and Particulate nature of matter which is practical-based. This strategy emphasizes the interaction of the learner with the environment, through activities with objects and events that lead to the discovery of new knowledge. Ethno-based chemistry practices addresses the nature of knowledge by providing a link between culture and science in any teaching process which results to meaningful learning. This strategy is in conformity with the Ausubels' theory which emphasizes active interaction of the learners with the environment. The teacher then explores the cultural experiences of the learners based on the initial experiences to teach the present school learners, chemistry and relate to their environmental usefulness.

Incorporating ethno-based practice in chemistry instructions may enable students to view chemistry as a familiar subject, and not one that is strange to the learners. It is worthy to note that some chemistry teachers tend to skip some topics due to the difficulty in understanding and explanation. Similarly, many students and teachers also experience chemistry concepts and principles as rather strange ideas, imported

from outside Africa (Indra and Bitwell, 2016). Some concepts in Chemistry are abstract for both teachers and students possibly because of the way it is taught and learnt, not relating it to day to day activities of the learner. Some teachers don't have any knowledge on how to use local materials in teaching Chemistry (Peni, 2011). Indeed, these indigenous chemically related practices may be used to make the unfamiliar chemistry content familiar to students. This is done by creating awareness to the teachers on the use of ethno-based practices in teaching and learning Chemistry. Consequently, considering the objectives of Chemistry curriculum, it is advocated that its teaching employs the use of local examples and practices to enhance conceptual understanding (Issa & Ibrahim, 2021). This will further make both the teachers and the learners to understand that certain practices and activities that are performed in their environment may be used to understand Chemistry thereby increasing the retention, achievement and performance of the students. There are some topics that learners find very difficult to understand (Iyke-ugwueze, 2022). Such topics include; acid-base titration, Chemical reactions, Particulate nature of matter and many others but these may be taught by using some of the local practice.

In the case of Chemical reactions, the traditional practice of blacksmithing can be used when teaching extraction of iron in the blast furnace, addition of nails to fermented cassava can be used to teach catalysis, addition of yeast to flour, heating of citric acid to give black residue can be used to teach the effect of catalyst and thermal decomposition respectively and many other ones. Apart from chemical reactions, the kinetic theory of matter also known as the atomic theory of matter has ethno-based Chemistry practices. The theory assumes that all matter consists of tiny particles called atoms which are always in motion. The fact that these particles are always in motion suggest that they have kinetic energy. The kind of motion exhibited by the particles depends on the temperature of the matter and some other factors. The particulate nature of matter is based on the following evidence: Brownian motion, Diffusion and Osmosis. There are some ethno-based chemistry practices that can be used to teach the learners. These include: movement of dust to teach diffusion, soaking of beans in water to explain osmosis, lighting of candle and blowing it off (solid-liquid), putting water in the freezer to change to ice (liquid-solid) to explain change of state and many more were listed to ascertain the awareness and use of the above listed practice in teaching kinetic theory of matter.

Despite the creation of awareness of the ethno-based practice by some researchers, Location of teachers also influences teaching of chemistry. School location has been a contentious issue in the determination of cognitive achievement in science education (Adekunle, 2017). Obi and Amba (2013) observed that students' performance is greatly affected by the area in which they live. Reasons for the variations in performance include geographic location, resources, availability of technology, quality of teachers, cultural settings and inclination, open mindedness, socio-economic status etc. Of great importance is the assertion that rural students are disadvantaged by their location, culture, and lack of access to similar facilities as their

counterparts living in the city. Similarly, the feel that the rural schools may be somehow inferior could affect students' performance.

The nature of environment where the learner grows and lives influences his world view and also learning. Linking learning to the learners' world view provides good learning opportunities to the learners. It is imperative to note that the geographical location of both the teachers and the school might have an effect on the level of teachers' awareness of ethno-based practice. Hence, this research work tends to find out if location influences the secondary school chemistry teachers' awareness of ethno-based teaching approach in delivering chemistry lessons in Enugu Education Zone?

Purpose of the Study

The purpose of this study was to determine the extent of teachers' awareness of ethno-based practice in teaching chemistry in government secondary schools in Enugu Education Zone Specifically, the study sought to;

1. determine the extent to which teachers are aware of ethno-based chemistry practice in teaching Chemical reactions;
2. determine extent to which teachers are aware of ethno-based chemistry practice in teaching particulate nature of matter;

Research Questions

The following research questions were formulated to guide the study:

1. To what extent are urban and rural chemistry teachers aware of ethno-based chemistry practice in teaching Chemical reactions?
2. To what extent are urban and rural chemistry teachers aware of ethno-based chemistry practice in teaching particulate nature of matter?

Hypotheses

The following null hypotheses were formulated and were tested at an alpha level of 0.05:

H_o1: There is no significant difference between the mean response scores of urban and rural chemistry teachers on the extent of teachers' awareness of ethno-based chemistry practice in teaching Chemical reactions.

H_o2: There is no significant difference between the mean response scores of urban and rural chemistry teachers on the extent of awareness of ethno-based chemistry practices in teaching Particulate nature of matter.

Methodology

The design of this study is a cross-sectional survey. Survey is a research method used for collecting data from a predefined group of respondents to gain information and insights into various topics of interest (Bhat, 2021). It is also an observational research type that analyzes data of variables collected at one given point of time

across a sample population or a predefined subset. This design was considered suitable for this study because it can be used to describe the variable in the study.

The area of this study is Enugu Education Zone. The population of the study was 72 Chemistry teachers. The sample size used was all the 72 chemistry teachers in Enugu Education Zone. The researcher purposively sampled all the 72 chemistry teachers in Enugu Education Zone because it is manageable population of chemistry teachers and this enabled the researcher to cover all the samples when administering the questionnaires. The sample was also chosen as the population so as to eliminate sample errors that usually arise in the course of sampling.

A 12-items questionnaire was the instrument used for data collection. The Ethno-based chemistry practice questionnaire (EBCPQ) was used to determine teachers' level of awareness and use of ethno-based practice. The EBCPQ was of the four-point rating scale type with the following response options: High extent (HE), Low extent (LE), Moderate extent (ME) and No extent (NE). To the response options with numerical values of 4, 3, 2 and 1 for positive response and 1, 2, 3, 4 for negative response were respectively assigned.

The instrument was validated by the three specialists to ascertain the content validation, clarity of the questions asked, suitability of the items and for general test format scrutiny. Two experts from department of science education and one expert from mathematics and computer Education. Data collected were analyzed using Cronbach Alpha Reliability coefficient and the overall reliability coefficient was 0.85. mean and standard deviation were used to answer research questions while t-test was used to test the hypothesis.

Data analysis and results

***Research Question 1*:** What is the extent of urban and rural teachers' awareness of ethno-based chemistry practices in teaching Chemical reactions?

Table 1: Mean responses and standard deviation of urban and rural teachers on the awareness of ethno-based chemistry practices in teaching Chemical reactions.

S/N		Urban Teachers 59			Rural Teachers 13		
		$\bar{x}$	SD	Dec	$\bar{x}$	SD	Dec
1.	Addition of excess salt in a pot when cooking fiofio (cajanus cajan) to explain catalysis in rates of reaction	2.93	0.81	HE	3.00	0.71	HE
2.	Addition of nails into a fermenting cassava for faster	2.58	1.18	HE	2.69	1.18	HE

S/N		Urban Teachers 59			Rural Teachers 13		
		$\bar{x}$	SD	Dec	$\bar{x}$	SD	Dec
	fermentation to explain catalysis in rates of reaction						
3.	Addition of yeast or baking powder to flour helps to explain effects of catalyst	2.49	1.09	HE	2.31	1.11	LE
4.	Exposure of nails to air or water to explain rusting	3.12	0.79	HE	2.15	0.80	LE
5.	Heating of citric acid to give black residue to explain thermal decomposition	2.03	0.87	LE	2.00	0.91	LE
	Grand Mean	**2.63**	**0.95**		**2.43**	**0.94**	

From Table 1 above, the results of data analysis for research question 1 indicated that urban chemistry teachers had mean scores and standard deviation scores of 2.63 and 0.95 respectively while the rural chemistry teachers had mean score and standard deviation scores of 2.43 and 0.94 respectively.

From the result, the urban chemistry teachers had high level of awareness to the items, which had mean responses that were higher than the cut-off point of 2.50 except for item (13) under the urban chemistry teachers while rural chemistry teachers are of low extent with cut off point which is less than 2.50. This also indicated that the teachers were close in their responses. It was then concluded that the urban chemistry respondents agreed to high extent level of awareness of ethno-based chemistry practices in teaching Chemical reactions except for rural teachers.

***Research Question 2*:** To what extent are urban and rural teachers aware of ethno-based chemistry practices in teaching particulate nature of matter?

Table 2: Mean responses and standard deviation of urban and rural teachers on the awareness of ethno-based chemistry practices in teaching particulate nature of matter.

S/N		**Urban Teachers 59**			**Rural Teachers 13**		
		$\bar{x}$	**SD**	**Dec**	**$\bar{x}$**	**SD**	**Dec**
6.	Mixture of clay and water which can be used to explain suspension	2.14	0.75	LE	2.23	0.71	LE
7.	Mixture of cooking oil, water and methylated spirit which can be used to explain colloid	2.44	1.06	LE	2.05	0.99	LE
8.	Lighting of candle and blowing it out after some time which can be used to explain change of state	3.08	0.82	HE	2.69	0.75	HE
9.	Movement of smoke or dust in air which can be used to explain Brownian motion	2.83	0.81	HE	2.85	0.90	HE
10.	Allowing soaked beans in water to swell up which can be used to explain Osmosis	2.03	0.83	LE	2.00	0.71	LE
11.	Boiling of water to change to vapour which can be used to explain change of state	2.75	1.06	HE	2.62	1.12	HE
12.	Spraying of perfume as it moves from an area of higher concentration to the area of lower concentration which can be used to explain diffusion	3.07	0.85	HE	3.00	0.91	HE
	Grand Mean	**2.62**	**0.75**		**2.49**	**0.87**	

From Table 2 above, the results of data analysis for research question 2 indicated that the urban chemistry teachers had mean scores and standard deviation of 2.62 and 0.75 respectively while the rural chemistry teachers had mean and standard deviation of 2.49 and 0.87 respectively.

With the grand mean of urban chemistry teachers which was higher than the cut-off point, it was then deduced that the urban chemistry teachers agreed to high extent level of awareness of ethno-based chemistry practices in teaching particulate nature of matter but with a different view with rural chemistry teachers.

Hypothesis 1: There is no significant difference in the mean response scores of urban and rural chemistry teachers on the extent of teachers' awareness of ethno-based chemistry practice in teaching Chemical reactions.

Table 3: t-test on the mean ratings of urban and rural chemistry teachers on the awareness of ethno-based chemistry practices in teaching Chemical reactions.

LOCATION	N	Mean	Std. Deviation	T	Df	Sig.	Dec.
URBAN	59	2.63	0.95	-0.22	70	0.44	S
RURAL	13	2.43	0.94				

Table 3 shows that the t value for the difference in mean rating of urban and rural chemistry teachers on the awareness of ethno-based chemistry practice in teaching Chemical reactions is (-0.22) and the significant at (0.44) level of significance, which is more than (0.05) set for the study. The null hypothesis is therefore rejected. This means that there was a significant difference in the mean ratings of urban and rural chemistry teachers on the extent of teachers' awareness of ethno-based chemistry practice in teaching Chemical reactions.

Hypothesis 2: There is no significant difference in the mean response scores of urban and rural chemistry teachers on the awareness of ethno-based chemistry practices in teaching Particulate nature of matter.

Table 4: t-test on the mean ratings of urban and rural chemistry teachers on the extent of awareness of ethno-based chemistry practices in teaching Particulate nature of matter.

LOCATION	N	Mean	Std. Deviation	T	df	Sig.	Dec.
URBAN	59	2.62	0.75	-1.12	70	0.08	S
RURAL	13	2.49	0.87				

Table 4 shows that the t value for the difference in mean rating urban and rural chemistry teachers on the awareness of ethno-based chemistry practices in teaching Particulate nature of matter is (-1.12), significant at (0.08) level of significance, which is greater than (0.05) set for the study. The null hypothesis is therefore rejected. This means that there was a significant difference in the mean ratings of

urban and rural chemistry teachers on the extent of awareness of ethno-based chemistry practices in teaching Particulate nature of matter.

Discussion of findings

Urban and Rural Teachers' Level of Awareness of Ethno-Based Chemistry Practices in Teaching Chemical Reactions.

The finding revealed to a high extent that urban teachers are aware of ethno-based chemistry practices in teaching chemical reaction while rural chemistry teachers were not aware of ethno-based chemistry practices in teaching chemical reaction.

This finding is in agreement with Roberts (2013) Chemical reactions are an integral part of technology, of culture, and indeed of life itself. Chemical processes are the changes, transformations, phenomena of the forming of new substances (Bataev, Lazurenko, Bataev & Burov, 2020). Certain substances are used to alter the rates of chemical reaction and some of those substances remain chemically and quantitatively unchanged at the end of the reactions. This is in agreement with Ababio (2013) catalysts are substances which speed up chemical reaction without itself undergoing any chemical change. Substances like nails when added to a fermenting cassava increase the rate of the cassava fermentation without altering the physical nature of the nails.

Comparison on the mean rating of urban and rural chemistry teachers on the awareness of ethno-based chemistry practice in teaching Chemical reactions indicated that there is a significant difference in the mean ratings of urban and rural chemistry teachers on the awareness of ethno-based chemistry practice in teaching Chemical reactions.

Urban and Rural Teachers' Level of Awareness of Ethno-Based Chemistry Practices in Teaching Particulate Nature of Matter

It was found to a high extent that urban teachers are aware of ethno-based chemistry practices in teaching particulate nature of matter except for rural teachers. This finding agrees with Oluwatosin, Edoga & Ogbu (2017) who conducted a research study that investigated the use of ethnochemistry teaching approach and achievement and retention of senior secondary students in standard mixture separation techniques. Matter is made up of discrete particles which are atoms, molecules and ions. Matter can exist as solid, liquid or gas. The kinetic theory of matter postulates that these particles are continually moving and so possesses kinetic energy (Ababio, 2013). This finding also agrees with (Ababio, 2013) that an increase in temperature causes an increase in the average kinetic energy because in any given sample of a substance, some particles are more energetic. Spaying of perfume, boiling of water, movement of smoke and many others all explain the kinetic theory of matter.

Comparison of rating scores of urban and rural chemistry teachers on the awareness of ethno-based chemistry practices in teaching Particulate nature of matter showed

that there was a significant difference in the mean ratings of urban and rural chemistry teachers on the awareness of ethno-based chemistry practices in teaching Particulate nature of matter.

Conclusions

Based on the findings of the study and the discussion that followed, conclusions were drawn as follows:

Urban chemistry teachers are aware of ethno-based chemistry practices in teaching Chemical reactions more than their rural counterparts. Location of teachers differed significantly on the awareness of ethno-based Chemistry practices in teaching Chemical reactions.

There was a significant difference in the mean ratings of urban and rural chemistry teachers on the awareness of ethno-based chemistry practices in teaching particulate nature of matter.

The respondents agreed that all the items for urban chemistry teachers had high levels of awareness of ethno-based chemistry practices except for rural teachers which had low levels of awareness.

Recommendations

Based on the findings and implication of the results, the following recommendations are made;

1. Teachers should find out ethno-based practice that can be used to enhance the teaching of chemistry for better performance of students in both practical and theoretical learning.
2. Seminars, workshop and conferences should be sponsored by the Federal and State ministries of Education as well as Post Primary School Management Board (PPSMB) to enlighten teachers on ethno-based teaching practices in the public secondary schools in Enugu State.
3. For effective adoption of ethno-based practice, some chemistry teachers associations should combine efforts to find out more ethno-based practice to be used for flexible teaching and learning.

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