

Effect of Ethno-Chemistry Instructional Strategy on Senior Secondary School Students' Achievement in Chemistry: A Quasi-Experimental Study in Ilorin West, Nigeria

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Abstract

The study investigated the effect of ethno-chemistry instructional strategy on senior secondary school students' achievement in chemistry education. Two research questions and hypotheses guided the study. The hypotheses were tested at 0.05 level of significance. The design of the study was quasi-experimental. The population of the study was 409 senior Secondary School year one (SS 1) chemistry education students in Ilorin west local government area of Kwara state, Nigeria. A sample of 50 students were drawn and used for the study. The instrument for data collection was chemistry education Achievement Test (CCAT). The reliability of CCAT was established using Kuder-Richardson formula 20 and found to be 0.69. Data were collected by administering the instrument as pretest and posttest after treatment of the groups. The mean, standard deviation, and Investigation of Covariance, also known as ANCOVA, were used to examine the collected data. The findings demonstrated that the experimental group, which was taught applying an ethno-chemistry instruction technique, had significantly higher mean achievement scores than the control group. Gender also had a substantial impact on pupils' academic performance. It was suggested that chemistry teachers use ethno-science as an instructional technique to connect learning and teaching to the students' cultural practices and other indigenous knowledge.

Keywords: Teaching, Strategy, Ethno-Science, Ethno-Chemistry

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Introduction

It is no gain saying that science and technology are important to a country's progress. This has become evident in the increasing quotas for scientific students class compare to their counterparts in other fields in the majority of nations, including Nigeria (Ajayi, Achor, & Agogo, 2017). Additionally, efforts are made to guarantee that Chemistry which is taught at the senior secondary school level of the Nigerian education is an important component of science education that satisfies the required standards necessary to address societal requirements. chemistry is the most fundamental field (Sutrisno, Wahyudiati & Louise 2020)..However, how to teach the subject to students using appropriate teaching strategy has been a source of worry to the stakeholders But the subject's nature raises an issue centered on the topic of which teaching strategy would be most effective in achieving its goals by using indigenous language and local expression to solved problems. The difficulty of teaching chemistry is made worse by the fact that the majority of the moment techniques for instruction, such embedding space chemistry into the curriculum, are minimally applicable in senior secondary schools in Nigeria. This is especially because performance of students in Chemistry in external examinations has been relatively poor. The majority of schools lack the resources and infrastructure necessary to employ appropriate instructional strategies. There is therefore a need to examine which instructional strategy would suit the teaching/ learning process of Chemistry. Hence, this paper examines the purpose of this study was to determine whether the use of ethno-science training to connect teaching and learning of chemistry to indigenous knowledge, cultural practices, and aphorisms such that they may enhance students' performance in Chemistry during SSCE.

The instructor presents cultural customs and information pertaining to the topic to the class as an introduction to ethno-chemistry. As the lesson progresses, through each step, the instructor provides a brief description of the concepts and invites the students to provide additional cultural information that is relevant to the idea. According to Chinn (2006), this instructional technique has the advantage of bridging the knowledge gap between the students' culture and the new topic of study. Zidny, Sjöström & Eilks (2020) assert that educators must use cultural anthropology, which views scientific learning as the acquisition of scientific culture. Ethno- chemistry may be useful in this context. This learning process leverages prior cultural

knowledge, giving students the chance to learn more about reality, culture, and themselves.

The effective use of this instructional technique can be influenced by teachers' gender among other factors. There has not been scholarly consensus regarding the influence of gender on the teaching of science-based subjects. It is anticipated that the gender gap in Chemistry as a subject can be closed since both male and female students are receptive to cultural customs and have the indigenous knowledge of their local community. However, there is a need to advance to investigate the impact of gender on students' performance when ethno- chemistry teaching is implemented.

Objectives of the Study

The general purpose of this study was to investigate the effect of an ethno-chemistry instructional strategy on senior secondary school students' achievement in Chemistry in Ilorin West Local Government Area, Kwara State.

- I. Determine the difference in the achievement scores of students taught Chemistry using the ethno-chemistry instructional strategy and those taught using the conventional method;
- II. Determine the difference in the achievement scores of male and female students exposed to the ethno-chemistry instructional strategy; and
- III. Examine the effectiveness of integrating indigenous knowledge, cultural practices, sayings and locally relevant examples into the teaching of selected Chemistry concepts.

Research Questions

- I. What is the difference between the achievement scores of students taught Chemistry using the ethno-chemistry instructional strategy and those taught using the conventional method?
- II. What is the difference between the achievement scores of male and female students taught selected Chemistry concepts using the ethno-chemistry instructional strategy?

Research Hypotheses

The following null hypotheses were tested at the 0.05 level of significance:

H₀₁: There is no significant difference between the mean achievement scores of students taught Chemistry using the ethno-chemistry instructional strategy and those taught using the conventional method.

H₀₂: There is no significant difference between the mean achievement scores of male and female students taught Chemistry using the ethno-chemistry instructional strategy

Methodology

The design adopted for the study was quasi-experimental design, specifically the pretest-posttest non-equivalent control group. The area of study was in Ilorin west local government area of Kwara state. The population of the study was 409 senior secondary school year one (SS 1) students in 2 secondary schools in Ilorin west local government area of Kwara state (Source: Quality assurance and Department of Planning, Research and Statistics, Post Primary School Service 2019). The sample size for the study was 83 (43 males and 40 females) senior secondary school year one (SS 1) students obtained using multi-stage procedure. First, two senior secondary schools under in Ilorin west local government areas of kwara state were selected. The rationale for their selection was because they are coeducational and situated far apart from each other, thus, the gender variable and extraneous variable of class interaction was taken controlled. The two schools were randomly assigned to experimental and control group. The experimental group had 44 students (24 females and 20 males) while the control group had 36 students (19 females and 17 males). The activity was conducted for a total of six weeks, with two lessons per week. There were twelve lessons in all, and each one lasted forty minutes.

The instrument used for data collection was Chemistry class Achievement Test (CCAT). CCAT was constructed based on the concepts taught while using a test blue print to ensure that adequate number of questions is covered each content taught. The 20 questions were designed on a short filling the gap.

CCAT and instructional plans were validated. The reliability of the instrument was established using Kuder-Richardson-Formula 20. The instrument was

administered once to 20 chemistry students in a school in Ilorin west area which was not used in the study. The generated scores were used to compute the reliability co-efficient. (0.69). the experiment was carried out in two phases. The first was the briefing of the research assistants who are the regular chemistry teachers in the schools used for the study and was done in two contacts within two weeks. The second was treatment using ethno-chemistry instructional strategy for the experimental group and conventional method for the control group. In the first week of the treatment, the pretest was administered to the two groups, and no feedback was given to them. In the same week, the treatment commenced. In each lesson, the teacher used an ethno-chemistry inventory containing sayings, cultural practices and indigenous knowledge of the school community that are related to the concepts for instruction.

The teacher first introduced the topic of the day by giving an exposition on a particular belief, knowledge or practice that is related to concept. Thereafter, the teacher gave a brief scientific explanation on the topic of separation techniques, Saponification and called on the students to present other cultural practices and knowledge, belief or sayings that are related to the concept for discussion. Some of the cultural practices on separation of mixtures presented by the students are: hand picking of large particles from the mixtures of sands and stones. Another concept is how black soap are made for cleansing of materials and body, it is made from the pulverized leaves or ash of a plant soaked in amount of water,(concentration) foam formation produced, and filtered to gained “soapy filtrate which can be used for washing and bathing.

During the discussion, the teacher using probing questions determined students’ understanding of the concept being taught in related to the indigenous knowledge the possess and classify their presentation into: compatible with chemistry and not compatible with chemistry. The teacher followed the same procedure in each step of instruction and evaluated the instruction at each step of the instructional delivery. At the close of instruction, a summary of the important points of the lessons was given by the teacher with an assignment on the next topic of instruction. The assignment was mainly to write up sayings, cultural practices and indigenous knowledge that are related to the concepts studied. Mean and standard deviation were used to analyze answer the research questions. The hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). The

decision rules are that when P-value is less than or equals 0.05, the null hypotheses will be rejected; otherwise we do not reject the null hypotheses.

Results

Research Question 1: What is the difference between the achievement scores of students taught Chemistry using the ethno-chemistry instructional strategy and those taught using the conventional method?

Table 1: Mean Achievement Scores of Students taught chemistry using Ethno-chemistry Instructional Strategy and those taught using Conventional Method

Group	N	pretest mean	posttest mean	gain mean	pretest SD	SD
Exp,	44	24.62	53.56	27.75	6.76	10.08
Control	36	28.90	43.05	13.19	5.98	6.98

Data in Table 1 show that the group taught using ethno-chemistry instructional strategy has mean gain achievement score of 27.75 while the control group taught using conventional method has mean gain achievement score of 13.19.

Research Question 2: What is the difference between the achievement scores of male and female students taught selected Chemistry concepts using the ethno-chemistry instructional strategy?

Table 2: shows the difference performance of male and female students taught Chemistry Concepts using Ethnochemistry based Approach?

Group	gender	N	pretest mean	posttest mean	gain mean	pretest SD
Exp,	M	24	28.62	55.56	24.75	6.76
	F	20	23.65	54.71	28.87	5.8
Control	M	19	26.90	47.05	13.89	5.38
	F	17	27.98	45.98	16.09	5.98

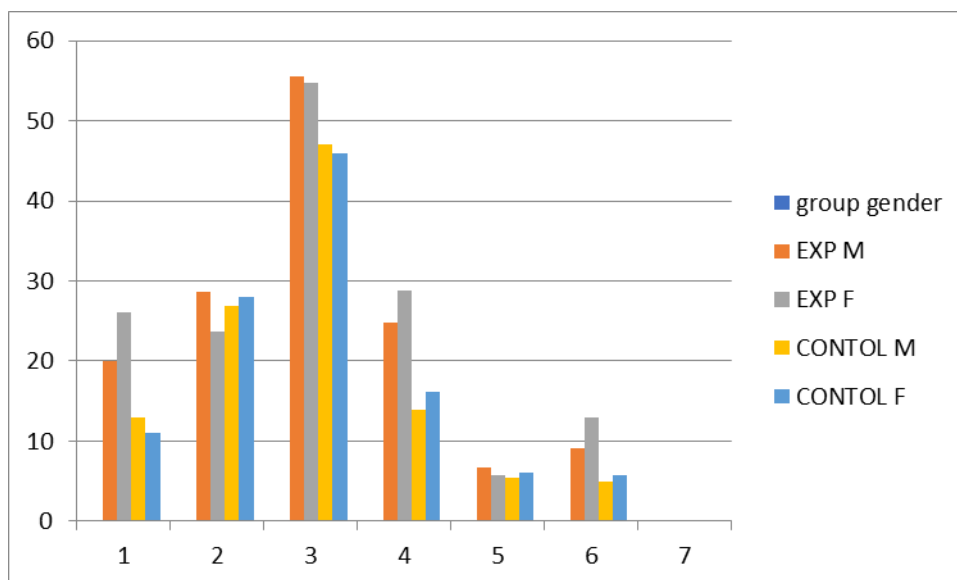


Figure 1: The bar chart of ethno-chemistry and how gender capability affects instructional strategy

Table 2 show that the male students taught using ethno-chemistry instructional strategy has mean gain achievement score of 25.42 while for the females, it is 29.84. The male students taught using conventional method has mean gain achievement score of 15.37 and the females, 11.59.

Hypothesis 1: There is no significant difference between the mean achievement scores of students taught Chemistry using the ethno-chemistry instructional strategy and those taught using the conventional method

Table 3: ANCOVA on Significance of Main Effects of the Treatment on Students' Achievement

Source of variation	SS	Df	MS	F	Sig.
Corrected Model	3183.508	4	795.895	11.110	.000
Intercept	9339.428	1	9339.428	130.376	.000
Pretest	290.530	1	290.530	4.056	.048
Gender	1640.061	1	1640.061	22.895	.000
S					
Method	526.852	1	526.852	7.355	.008
S					
Method*Gender	79.120	1	79.120	1.104	.297
Error	4942.799	69	71.635		NS
Total	181902.000	74			
Corrected Total	8126.378	73			

Table 3 show that there is a significant main effect of the treatment on the achievement scores chemistry students, $F(1, 73) = 22.895$, $P(0.000) < 0.05$. Thus, the null hypothesis was rejected. Therefore, there is a significant difference between the mean achievement scores of students taught chemistry using ethno- chemistry instructional strategy and those taught using conventional method.

Hypothesis 2: There is no significant difference between the achievement scores of male and female students using ethno-chemistry instructional strategy and those taught using conventional method. . Table 3 also shows that there was a significant main influence of gender on students' achievement in chemistry, $F(1, 73) = 7.355$, $P(0.008) < 0.05$. Thus, the null hypothesis was rejected. Therefore, there is no significant difference between the achievement scores of male and female students.

Discussion

Students became more interested in the lesson as learning was brought close to the real world and learnt concepts and their applications in life was clear. The finding of the study is in line with the findings of Singh, Chibuye (2016) that ethno-chemistry instruction significantly enhanced students' achievement in Chemistry. Ajayi, Achor and Agogo (2020) stated that ethno-chemistry instruction was more effective in facilitating and improving students' retention in statistics than the conventional approach. The findings of the study further lend credence to the findings of Sutrisno, Wahyudiati, and Louise (2020) that students taught using ethno-chemistry instruction had significantly higher achievement scores than those students not taught with ethno-chemistry.

The study further showed that gender significantly influenced the students' achievement in chemistry. The interaction plot showed that the influence of gender on achievement was ordinal. The sensitivity to gender can be explained from the angle of the fact in the most cultural setting; women are often involved in most domestic and cultural activities, exposing them to more science-related practices. On the other hand, males are involved in cultural works which most times have scientific relevance. The finding of the study is in contrast with the findings of Rosa and Orey (2011) that ethno-mathematics teaching approach did not significantly differentiate between sexes.

Conclusion

It can be concluded from the findings of the study that ethno- chemistry educational strategy is effective for enhancing students' achievement in Chemistry. The educational strategy gives students an in-depth understanding into Chemistry.

Recommendation

- I. In order to positively communicate and maintain their students' attitude toward understanding the principles they have been taught, chemistry teachers should be encouraged to start their classes with relevant ethnochemistry exercises. Students would have a stronger sense of belonging and always view chemistry as their own topic rather than a foreign one as a result of this.
- II. In order to improve students' attitudes, textbook authors and publishers should bolster their explanations of the material with pertinent examples, practices, and illustrations from indigenous cultures and science. Their textbooks would become more amiable as a result.

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