EFFECTS OF GUIDED-INQUIRY TEACHING METHOD WITH ENGLISH LANGUAGE ON STUDENTS ACADEMIC ACHIEVEMENT AND RETENTION IN THE CONCEPT OF ELECTROCHEMICAL CELLS IN ITU EDUCATIONAL ZONE, NIGERIA.

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ABSTRACT

The study investigated the effects of guided-inquiry teaching method with English language on students' academic achievement and retention in the concept of electrochemical cells in Itu Educational Zone, Nigeria. In pursuance of the study, four purpose of study, four research question and four null hypothesis were carefully formulated to guide the study. Quasi-experimental research design was adopted for the study and a non-randomized pre-test, post-test setting, the study area was Itu with a target population of all the SSII chemistry students in the 2024/2025 academic session drawn from all the nine (9) public secondary schools in Itu wth a sample size of 200 senior secondary two (SS2) chemistry student drawn from four out of the nine (9) public secondary schools in Itu Local Government Area of Akwa Ibom State. Mean and standard development was used to answer the research question and independent t-test was adopted to test the hypotheses which was tested at 0.05 level. The findings of the results showed that students who were taught electrochemistry cell using guided-inquiry with English language had a better achievement score than their counterpart who were taught using mother tongue with lecture method and it was recommended that government at all level should implement the use of English language with guided inquiry in public secondary schools in the state in the teachers and learning of the concepts of electrochemical cells in government secondary schools in Itu Educational Zone.

KEYWORDS: English Language, Student Academic Achievement, Student Retention and Electrochemical Cell

INTRODUCTION

English language emerged from the dialets and vocabulary of Germanic peoples, Angles, Saxons, and jutes who settled in Britain in the 5th century C. English today is a constantly changing language that has been influenced by a plethora of different cultures and languages such as, Latin, French, Dutch and Afrikaans (Thomas Pyles 2024).

Scientific research reveals meticulously that all most all the branch of science are taught and best explain to the understanding of learners in both spoken and written English which is the only Linqua Franca adopted all over the world for the invention, innovations and communication of scientific theories and inventions (Brain 2023).

Sunday (2023) also opined that it is a well-known fact to know that the transmission and communication of scientific knowledge will be practically impossible without that use of knowledge, hence, the theories, inventions, scientific name, teaching method's practical instruments, laboratory equipment reagents etc. are all given expression in written and spoken English.
Chemistry is a branch of science which deals with the study of nature, its properties, composition and elements, as well as its applications. Chemistry is one of the most important disciplines in the school curriculum: its importance in the general development of education has a worldwide recognition (Burmuster, 2012). The importance of science and technology to notional development in the life of any country cannot be overemphasized without the use of spoken and written English language.

Silas (2014) stated that when science programmes are well planned and implemented. It will promotes the interest and retention of students which is seen in their feelings of wanting to learn more about sciences and also boost their academic achievement and retention in their chosen area in as much it's taught in English language.

Electrochemical cells is a concept of chemistry which is taught in senior secondary two (SS2) class. This concept has to do with an electrochemical cells which is commonly referred to as volcanic and galvanic cells. It is used in driving our automobile vehicles and in our electricity generating cells. Electrochemical has also been remodified to power our houses in the absent of generator and electricity (Brain 2021). It comprises of a positively charge Anode (+) and a negatively charge cathode with a (–) charge sign some comes water otherwise known as electrolyte with a combination of H reacting with chlorine which is HCL.

The body of the electrochemical cells is made up of a strong insulator. In the concept of electrochemical cell, we have redox reaction, electrochemistry, faraday's laws of electrolysis and some calculations. Students and teachers have seen has a difficult concept in chemistry, as such poor academic achievement have been recorded in some years past and this negative development have been link to poor teaching strategies adopted by teachers in the past years and the past years leading to low academic achievement in the concept of electrochemical cell in chemistry in Itu Educational Zone, on this note, the researcher is bent on introducing the following teaching strategies to see if the strategies introduce could effectively enhance the

teaching of the concept. The following teaching methods will be employed in this research.

(1) Guided-inquiry teaching strategies
(2) Lecture teaching strategies

Throughout the three weeks of this research exercise. The above enumerated teaching strategies will be adopted for the study. The teaching method will be use to measure students' achievement and retention in secondary schools in the concept of electrochemical cells. Guided-inquiry is a teaching strategies adopted for investigations by a facilitators during classroom instructions. This teaching methods helps the teacher to guide and direct the learners to investigate, demonstrate deeply on what they learners do not have a total knowledge about. It serves as a follow up for the teachers to ensure that the learner's assimilate and understands what is being impacted.

Guided-inquiry teaching method means to inspire, guide, follow up, monitor, teach, observe, directs Sunday (2021).

English language is a language of expression adopted all over the world by lovers of education to transmit knowledge to the understanding of the learners Silas (2014). It is use by teachers to transmits, convey and impact knowledge. It is available both in spoken and written form and it was emanated from England.

This study intends to examine how the use of English language and guided-inquiry teaching strategies will enhance the teaching and learning of electrochemical cells in secondary schools in Itu Educational Zone of Akwa Ibom State, Nigeria.

Lecture method of teaching is a verbal presentation of ideas, facts, concepts, theories, principles and laws of science by a teacher to students. The students listen to the teacher and obtain the information with less options of no or yes. Lecture method of teaching is a teacher-centered teaching strategies which as to do with what the teacher says seems to be the ultimate. Guided-inquiry is a teaching method that allows students to seek and engage with a variety of ideas to increase their understanding in pursuit of knowledge and greater awareness. It is a practical way of discovering concepts through an active anticipation (Jin and Bierma, 2011).

The use of English language with regards to guided inquiry teaching method in chemistry is encouraged because it enhances student's participation in science classes (FME, 2012). English language with regards to the teaching and learning of electrochemical cells have a significant role towards technological development and

advancement in a developing nation since chemistry is embedded in our daily life and circular undertakings.

Statement of Problem

The 2023/2024 Chief Examiners report of the West African Examination Council Certificate Examination Result (WAEC) and the National Examination Council Examination result (NECO) in chemistry reveals that students' academic achievement in the concept of electrochemical cells seems to be poor and this negative development has been attributed to poor teaching method adopted by teachers in the teaching method of this concept and the poor use of English language in the explanation of this concept. This development have call for a great concern from government both at the local, state and federal level. Curriculum developers, students, parents, teachers, textbook publishers', proprietors and researchers are seriously worried about this ugly development and the situation have motivated and inspired the researcher to embark on the present research titled: Effect of English language with guided-inquiry on students' academic achievement and retention in electrochemical cells in secondary schools in Itu educational zone of Akwa Ibom State. The researcher intends to see how the use of guided-inquiry and lecture teaching strategies with English language will effective enhance the teaching of the concept of electrochemical cells in Itu Educational Zone of Akwa Ibom State.

Objective (s) of the Study

1. To compare the differences in student academic achievement in the concept of electrochemical cells in chemistry when taught using English language with guided-inquiry and those taught using English language with lecture teaching methods.
2. To compare the differences in student academic achievement in electrochemical cells in chemistry when taught using mother tongue with guided-inquiry and those taught using mother tongue with lecture teaching method.
3. To compare the differences in student retention ability test in electrochemical cells in chemistry when taught using English language with guided-inquiry and those taught using English language with lecture teaching method.
4. To compare the differences in student retention ability test in electrochemical cells in chemistry when taught using mother tongue with guided-inquiry and those taught using mother tongue with lecture teaching method.

Research Questions

The following research questions were formulated to guide the study.

1. What is the difference in student academic achievement in the concept of electrochemical cells in chemistry when taught using English language with guided-inquiry and those taught using English language with lecture teaching method?

2. What is the difference in student academic achievement in the concept of electrochemical cell in chemistry when taught using mother tongue with guided-inquiry and those taught using mother tongue with lecture teaching method?
3. What is the difference in student retention ability test in the concept of electrochemical cell in chemistry when taught using English language with guided-inquiry and those taught using English language with lecture teaching method?
4. What is the difference in student retention ability test in electrochemical cell in chemistry when taught using mother tongue with guided-inquiry and those taught using mother tongue with lecture teaching method?

Hypotheses

1. There is no significant difference in student academic achievement in the concept of electrochemical cells in chemistry when taught using English language with guided-inquiry and those taught using English language with lecture teaching method.
2. There is no significant difference in student academic achievement in the concept of electrochemical cell in chemistry among student taught using mother tongue with guided-inquiry and those taught using mother tongue with lecture method.
3. There is no significant difference in student retention ability test in the concept of electrochemical cell in chemistry when taught using English language with guided-inquiry and those taught using English language with lecture method.
4. There is no significant difference in student retention ability test in the concept of electrochemical cell in chemistry when taught using mother tongue with guided-inquiry teaching method and those taught using mother tongue with lecture teaching method.

Literature Review

Theoretical Framework

Piaget's Theory of Cognitive Development (Piaget, 1936)

This theory was propounded by Jean Piaget in 1936. He lived between 1896 and 1980. Piaget was a Swiss psychologist and genetic epistemologist. An important implication of Piaget's theory is adaptation of instruction to the learner's developmental level. The content of instruction needs to be consistent with the developmental level of the learner. The teacher's role is to facilitate learning by providing a variety of experiences. Teacher should obviously provide opportunities for learners to explore and experience, by doing so is encouraging learner's new understandings. Piaget emphasizes the opportunities that allow learners to different cognitive levels to work together and encourage less mature students to advance to create understanding. This theory further emphasizes on the use of concrete hands of experiences to help learners learn additional suggestions. Piaget also emphasizes that

teachers should allow opportunities to classify and group information to facilitate assimilating new information with previous knowledge.

This theory is related to the present study as instruction in Chemistry is adopted to the learners' to see how the effective use of English language with guided-inquiry teaching strategies will enhance chemistry students achievement and retention on the concepts of electrochemical cells in secondary schools in Itu Educational Zone.

Empirical Research

Aladejana (2007) examined the influence of laboratory environment and academic performance of students. The modified ex-post facto design was used. A sample of 328 randomly selected students was taken from a population of all senior secondary school Chemistry students in a Lagos State, Nigeria. The research instrument for the study was Science Laboratory Environment Inventory (SLEI) that was administered on the selected students. Data analysis was done using descriptive statistics and Product Moment Correlation. Findings revealed that students could assess the five components (Student Cohesiveness, Open-endedness, Integration, Rule Clarity, and Material Environment) of the laboratory environment. Student cohesiveness has the highest assessment while material environment has the least. The results also showed that the five components of the science laboratory environment are positively correlated with students' academic performance. The findings were discussed with a view to improving the quality of the laboratory environment, subsequent academic performance in science and ultimately the enrolment and retaining of learners in science.

Umara (2017) conducted a study on the effects of availability and utilization of Biology laboratory facilities and students' academic achievement in secondary schools in Yobe State of Nigeria. The study adopted a correlational survey research design and was guided by two research questions and one null hypotheses tested at 0.05 level of significance. The population of the study comprised of all the 42 Biology teachers and 10,231 Biology students across all the senior secondary schools in Yobe State. Stratified random sampling technique was used to select the student sample (370). The entire 42 Biology teachers were used for the study since the size was manageable. A questionnaire containing a checklist (Biology Laboratory Facility) and a proforma were used for data collection. Data from research questions were analyzed using Mean and Standard Deviation while Pearson Product Moment Correlation Coefficient and Multiple Correlation Analysis were used for the null hypotheses. The reliability coefficient of the instrument was obtained to be 0.84 using Cronbach Alpha. The findings of the study revealed that Biology laboratory facilities are either not available entirely, or where they are available they are inadequate and therefore they are not utilized by the high number of students population. There was a significant

relationship between Biology laboratory facility availability and utilization, and students' academic achievement $r = .614$, $n = 42$, $p < 0.05$, $r = .572$ and $r = .590$, $n = 370$, $p < 0.05$.

Guided-Inquiry

Guided-inquiry is a teaching method or strategy where the teacher guides the learners on the method. Ratnaningrum et al. (2015) described guided-inquiry as a learning method in which the teacher provides students with guidance and instructions about the study materials. The teachers also give the learners the experience of thinking independently and interacting with friends through discussion forums. In summary, guided-inquiry is a teaching learning process that emphasizes the need for students, under the guidance of the teacher to a problem in question and to search and investigate systematically, logically and critically to formulate their own findings.

English Language

English language is a global acceptable dialect borrowed from England use generally in teaching and learning of science related concept. Silas (2014) opined that the use of English language facilitates and enhances the effective teaching and learning of science related discipline. Thus both the learner and the teacher adopts the use of English language in teaching professional discipline such as chemistry, considering the abstract nature of chemistry and its difficult concepts such as electrochemical cells, a concept that deals with the production of electricity through the use of electrolyte, Anode, cathode and cells can best be taught in secondary schools with the help of English.

Lecture Method

Lecture method is a teaching method which is usually categorized as one way information from the teacher to the learner, who is always active to the learners in learning and teaching situation.

Academic Achievement

Academic achievement has been described as scholastic standing of the student at a given moment. It also refers to how well an individual is able to demonstrate his or her intellectual abilities successfully, especially using their own efforts and skills (Agbade and Awodun, 2014).

Research Methodology

Research Design

The research adopted a quasi-experimental research design.

Area of the study

The area of the study was Itu Local Government Area of Akwa Ibom State. Itu Local Government Area is one of the local government area located in Akwa Ibom State and it is surrounded by six (6) local government area which Ikot Offiong, Ikono, Ibiono, Uyo, Uruan and Ikot Ekpene local government area respectively. It has a land mass of 285,420 square kilometers lying between the latitude of $4^{o}25^{o}$N and 5^{o}32N North of the equator and longitude of 7^{o}29 of east of Greenwich Meridian with the population of 502, 3126 people. The people of Itu speaks Ibibio, Efik and English language. There are nine (9) public secondary schools located in Itu Local Government Area, according to the Itu local education committee.

Population of the Study

The target population for this study was all the SSII chemistry students in the 2024/2025 academic session in all the nine (9) public secondary schools in Itu and this study consists of five (5) SSII secondary schools students. There is about 2000 students offering chemistry in the study area according to (Local Education Authority, Itu).

Sample and Sampling Technique

The sample size for the study was 200 senior secondary two (SS2) chemistry student drawn from four (4) out of the nine (9) public secondary schools in Itu Local Government Area of Akwa Ibom State 50 students was drawn from each of the schools selected for the study. A non-randomize sampling technique was adopted for the study.

Method of Data Collection

This research was carried out within a period of 35-48 weeks. The researcher develop achievement and retention ability test. The researcher also design a lesson package using the teaching method which shall be English with lecture method, English language guided-inquiry, mother tongue with lecture method and mother tongue with guided-inquiry for the teaching of the concept of electrochemical cell for the four (4) public selected schools in Itu Local Government Area selected for the study.

Method of Data Analysis

The data was statistically analysed using mean and standard deviation to answer the research question and independent t-test was used in testing the hypotheses at 0.05 level of significant.

Data Presentation, Results and Discussion

Answering the Research Question and Testing the Hypotheses

The three research questions was raised are answered in this subsection.

Research Question 1: What is the difference in student academic achievement in the concept electrochemical cells in chemistry when taught using English language with guided-inquiry and those taught using English language with lecture method?

Table 1: Mean (x) and standard deviation of students' pretest and post-test scores classified by treatment groups

Treatment Groups	N	Pre-test		Post-test		Mean Gain Score
		Mean	SD	Mean	SD	
Guided-Inquiry		93	25.70	68.34	2.70	41.55
English Language		77				31.6
Expository Method		10	26.40	64.61	3.87	36.21

Table 1 shows the pre-test and post-test mean scores and standard deviation of scores of the three groups of students taught using guided-inquiry, English language and lecture teaching learning strategies.

The post-test – pre-test mean gain scores of 41.55, 36.28 while those taught using 41.55 had the best mean scores which indicates that guided inquiry was more effective in the teaching of electrochemical cells in secondary schools.

Research Question 2: What is the difference in student academic achievement in the concept of electrochemical cell in chemistry when taught using mother tongue with guided inquiry and those taught using, mother tongue with lecture teaching method.

Table 2: Mean and standard deviation of students' pretest and post-test scores classified by treatment and gender

Treatment Groups	Gender	N	Pre-test		Post-test		Mean Gain Score
			Mean	SD	Mean	SD	
Guided-Inquiry	Male	49	27.43	4.97	68.33	2.53	40.90
	Female	45	26.09	4.73	68.36	2.90	42.4
Mother-Tongue	Male	36	26.00	5.01	66.48	4.02	40.
	Female	42	27.95	4.45	65.17	4.18	3.
Lecture Method	Male	53	27.34	4.93	64.85	4.00	32.5
	Female	56	27.47	4.48	64.39	3.70	36.9

These observations show that the female students taught using guided-inquiry had the highest mean gain scores followed by the male counterparts in the same group, the males in mother tongue group. Whether the differences between the mean scores of the three groups by gender we are statistically significant is assessed by the results in Table 2 is used in the testing of hypothesis two.

Null Hypothesis 2

There is no significant difference in student academic achievement in the concept of electrochemical cell in chemistry among student taught using mother tongue with English language.

Treatment Groups	Gender	N	Pre-test		Post-test		Mean Gain Score
			Mean	SD	Mean	SD	
Guided-Inquiry	Male	49	27.43	4.97	68.33	2.53	40.90
Mother-Tongue	Female	45	26.09	4.73	68.36	2.90	42.22
Lecture Method	Male	53	27.34	4.93		64.85	37.71
	Female	50	27.47	4.48		64.39	36.92

Table 3: Summary of Analysis of Covariance (ANCOVA) of male and female students post-test – test scores classified by treatment group and gender with pre-test scores as covariance.

Source	Type III Sum of Square	df	Mean square	F	Sig
Pre-test	2.10	1	2.10	24	63
Treatment	5711.83	2	225.91	27.5	00
Gender	3.80	1	3.80	45	50
Treatment	23.50	2	8.44	1.30	27
Error	2257.62	231	6.98		
Total	123412.00	241			
Corrected to	2111,61	280			

Research Question 3: What is the difference in student's retention ability test in the concept of electrochemical cell in chemistry when taught using English language with guided-inquiry and those taught using English language with lecture teaching method?

Table 3: Mean and standard deviation of students pre-test and post scores classified by treatment groups and school location.

Treatment Groups	Location	N	Pre-test		Post-test		Mean Gain Score
			Mean	SD	Mean	SD	
Guided-Inquiry	Urban	34	25.97	4.00	59.77	1.17	43.30
	Rural	57	25.57	4.82	66.73	3.14	41.65
English language	Urban	37	26.38	4.82	64.77	13.71	39
	Rural	41	27.66	4.61	64.95	4.50	37.6
Lecture Method	Urban	56	27.71	4.50	64.87	3.93	37.16
	Rural	53	27.08	4.80	64.34	3.85	37.26

Table 3 shows the pre-test, post-test mean scores and standard deviation of scores of the students in Urban and Rural school taught using guided-inquiry with English language and teaching methods. The scores display 43.30 and 41.05 respectively while the counterpart 39.10 and 38.61 respectively for urban and rural public secondary schools. The above analysis shows that students taught electrochemical cells has a higher scores of than others, indicating that guided-inquired enhances students achievement in the concepts of electrochemical cells than other students taught the concept of electrochemical cell using other teaching strategies.

Research Question 4: What is the difference in student retention ability test in electrochemical cell in using mother tongue with lecture teaching method?

Table 4: Mean and standard deviation of students pre-test and post-test scores classified by treatment groups and school lecture.

Treatment Groups	N	Pre-test		Post-test		Mean Gain Score
		Mean	SD	Mean	SD	
Guided-Inquiry	64	25.70	4.81	65.31	2.10	40.55
Retention Test	50	27.01	4.71	62.21	4.12	38.82
Mother Tongue	9	27.20	4.59	61.21	3.87	36.10

The post-test standard deviation scores 40.55 and 3.87 for students in guided-inquiry retention scores and 36.10 for mother tongue individual that there's a decrease in the retention test of student considering 38.82.

Summary of Findings

1. There was a significant difference in the mean achievement scores of the students in the concepts of electrochemical cells with students taught using guided-inquiry with English language and lecture method following the decrease in rank order. Students taught electrochemical cell using guided-inquiry had a comparable achievement.
2. The influence of gender on the students' performances was not statistically significant.
3. The influence of students' retention was not statistically significant.

Discussion of Findings

Guided-inquiry and students achievement in electrochemical.

The finding with regard to the effect of guided-inquiry student's achievement in electrochemical cells showed that there was a significant difference in the mean achievement scores of the students in the concept taught using guided-inquiry with English language, hence students in those group had a better academic achievement than the counterpart. This observation was in agreement with those of Udo (2011), Agbir (2014), Likenla et al., (2016).

Education Implications of the Findings

The findings of this study have provided empirical evidence for the effectiveness of guided-inquiry, with English language and lecture teaching methods which suggested that the use of guided-inquiry with English language enhances students' academic achievement in electrochemical.

CONCLUSION

This study investigated the effects of guided-inquiry with English language on student academic achievement and retention in public secondary schools in Uyo, four objectives foru research question and four hypotheses were use in the study. Based on the findings of the study, it is hereby concluded that of the three strategies one teaching method was more effective, guided-inquiry with English language, enhances student academic achievement on the concept of electrochemical cell.

RECOMMENDATION

Based on the findings the following recommendations are made.

1. Chemistry teachers should adopt the use of guided-inquiry with English language when teaching electrochemical cell.
2. Curriculum planners should incorporate guided-inquiry in the effective teaching and learning of chemistry.
3. Government through educational agencies should construct workshops and seminars for the training of teachers in teaching chemistry by the use of guided-inquiry with English language in teaching chemistry.

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