TEACHING METHODS AND BIOLOGY STUDENTS' ACADEMIC ACHIEVEMENT IN EKET FEDERAL CONSTITUENCY OF AKWA IBOM STATE

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Abstract
The study investigated ''Teaching Methods and Biology Students' AcademicAchievement in Eket Federal Constituency of Akwa Ibom State.Four research questions and four null hypotheses were formulated to guide the study. The research design adopted for the study was quasi-experimental, specifically pre-test-post-test non-equivalent control group design. The population size was 2,829 senior secondary one (SS 1) Biology students. Multistage sampling technique was used to select a sample size of one hundred and fifty (150) senior secondary one (SS1) Biology students for the study. The students were drawn from three intact classes in three co-educational public secondary schools in Eket Federal Constituency. Biology Achievement Test (BAT) developed by the researchers was the instrument used for data collectionfor the study. The instrument was validated by an expert in Faculty of Education and two independent assessorsfrom Akwa Ibom State University. The instrument was tested for its reliability using Kuder-Richardson formula-20 and a reliability coefficient of 0.85 was obtained. The result of the study showed a significant difference in the mean achievement scores of Biology students taught the concept of classification of animals using concept mapping, field trip and expository method. Students taught using concept mapping achieved significantly higher than those taught using field trip and expository methods. Hence, concept mapping was the most effective method, followed by field trip while expository method was the least effective. Gender was not found to be a significant factor affecting students' achievement in the study. Based on the findings of the study, it was recommended that Biology teachers should adopt the use of concept mapping and field trip methods to teach Biology concepts for efficient learning output and high students'academic performance.

Keywords: Teaching methods, concept mapping, fieldtrip and gender, Biology students.

Introduction

Education is a crucial sector in any nation, including Nigeria. It plays a major role in long-term productivity and growth at both micro and macro levels. It is the primary tool for the overall development of the society. It connotes knowledge or skill acquired or developed through a learning process. It can also be regarded as the process of helping the individual adjust to this changing world (Itighise, 2016). Education is an instrument for the emancipation of the individual and the society (Akpan, Oyakhirome, & Udoh 2024). It is a light that shows mankind the right direction to surge and that its purpose is not just making students literate but adds rationale thinking, creativity and self sufficiency for self reliance which are cherished in every civilized society.

Science is a tool that is important to individuals and the nation as a whole, for survival and to meet the global economic requirement. This implies that science subjects continue to be one of the most important subjects as the world is currently at a stage where its wealth and

economic development is highly dependent on the science workforce. According to Babayemi (2024), the poor performance of students in secondary schools in science is still a major concern to researchers and stakeholders in education. Science is derived from the Latin word ''Scienta'' meaning ''Knowledge'' Science is the acquisition of knowledge through observation, measurement, recording and interpretation of scientific concepts. In other words, science as a practical subject provides students with an opportunity to demonstrate scientific skills that can be used to solve problems in everyday life and contributes to national development (Kola & Abdulrahman, 2020).

Innovation in science education in this 21st century is necessary since it is called 'globalization era' that is a brain child of science (Akpan, 2014; Itighise, 2016). Science provides students with the richest experiences which they will transfer to the society. Akpan and Itighise, (2021)., Adie, Obi, Okri and Ogbe, (2020) poisted that scientific and technological knowledge and skills ''invade'' all realms of life in modern society; therefore, scientific and technological skills are crucial for most of our actions and decisions and thus, the teaching of science and technology should be for mastery learning to meet up with the demands of the present era. As maintained by Asalusan (2018), the aims and objectives of teaching science in Nigeria are to encourage and enable students to develop inquiring minds and curiosity about science and the natural world, acquire knowledge, conceptual understanding and make informed decision in Scientific and other contexts, develop skills of scientific evidence to draw conclusions, communicate scientific ideas and practical experiences accurately in a variety of ways and think analytically, critically and creatively to solve problems. Science subjects at secondary school level comprises of Mathematics, Chemistry, Basic Science and technology, Physics, Agricultural Science and Biology.

Biology as a branch of science occupies a unique position in the secondary school education curriculum because of its importance as science of life. In Nigeria, secondary school Biology curriculum is designed to continue students' investigation into natural phenomenon, to deepen students' understanding and interest in biological science and also encourage students' ability to apply scientific knowledge to everyday life in matters of personal, community health and agriculture among others (Federal Ministry of Education, 2014). The current Nigerian Secondary School Biology curriculum is developed to provide students with the knowledge of the concept in Biology to ensure that students learn biological concepts meaningfully to promote their understanding of the world around them. The Biology curriculum as a teaching syllabus has four main objectives derived from the National Policy on Education, (FRN, 2014). These objectives include; adequate laboratory and field skill in Biology; Meaningful and relevant knowledge; Ability to apply specific knowledge to everyday life to the matters of personal and community health and agriculture; Reasonable and functional scientific attitudes.

Biology curriculumis also aimed at developing broadly applicable skills such as problem solving, communication, critical thinking and objective reasoning abilities to enable students prepare for work place and self-sustainability in the world economy. With these objectives in mind, students are expected to be useful and productive members of the society. Despite the complexity of Biology, there are certain unifying concepts that consolidate Biology into a single coherent field. Biology recognizes classification of animals as the process of placing together in categories those animals that resembles each other. In other words, classification of animals is a way of grouping animals by their similar characteristics. This system of classification was introduced by Carolus Linnaeus in 1758. The concept of classification of animals includes abstract concept, event, subtopics and factors that students have to learn which makes the concept difficult for the students. Classification of animals as examined by Chylenska and Rybska (2018) can be very difficult for the students.

Students have similar conception about the concept thereby finding it difficult to classify animals and apply this concept in practice. Chylenska and Rybska (2018) commented that the purpose of teaching the concept of classification of animals in senior secondary school is to make animals easier to identify, describe, organize, differentiate, find and study. Besides, the importance of Biology to mankind as the science of life is one of the science subjects mostly preferred by many students in the senior secondary school because it has less mathematical calculations unlike Physics and Chemistry and deals with non-abstract things. Biology is offered by many students in the secondary schools and it is a building bridge to chemistry, physics, Mathematics and Information science and other disciplines. This high rate of failure has been attributed to some vital issues and challenges confronting Biology education as; unavailability of Biology equipment, inadequate Funding, voluminous curriculum contents and teachingmethods.

Considering the central role played by Biology in the Nigerian economy, it is necessary to identify and apply teaching methods that are appropriate for Biology learning in senior secondary schools. An appropriate teachingmethod employed would help ease the level of difficulty faced by the learners as they learn scientific concepts (Babayemi, Akpan & Emah, 2018). The inadequacy of science teaching methods and total absence in some cases calls for alternative efforts at making science teaching and learning effective and impactful; this calls for resourcefulness on the part of the teacher (Akpan, 2022). However, researchers like Etim, Itighise and Ema (2016) observed that innovative strategies such as slow motion animationthough abused by most teachers can be combined with other methods to enhance instruction. The innovative teaching methods are activity-based and are characterized by students sharing some degree of responsibility for making decision in the teaching and learning process. In similar view, Itighise and Umanah (2019), comments that flipped classroom model serves as powerful instructional tools and allow teachers create content, share resource and improve upon their instructional practices. Aytac and Kula (2020) commented that one way of improving students' academic achievement towards Biology is through the adoption of students'-centred and activity-based methods such as field trip and concept mapping.

A concept map or a conceptual diagram is a diagram that depicts suggested relationships between concepts. It represents information and ideas as boxes or circles which it connects with arrows often in a downward, branching, hierarchical structure. In this study, a concept map is a visual representation of information. Concept mapping teaching method, according to Ariaga and Nwanekezi (2018) is an activity-based strategy that provides students with an opportunity to organize, summarize, analyze and evaluate different concepts. In other words, concept mapping helps students build their knowledge based on a given discipline or on a given concept taught and it facilitates students' ability to solve problems by providing a basis for discussion among students and to summarize several Biology concepts.

Field trip teaching method as defined by Estawul, Sababa and Filgona (2016) is an activity-based strategy which gives opportunity for students to get first-hand information on people, place and things in order to make their learning experiences real. In his contribution, Addo (2021) defined field trip as a method of teaching that involves taking the students for an excursion outside the classroom for the purpose of making relevant observations necessary for understanding the concept under study. Field trip offers students first-hand experience since they see and observe processes in natural life settings. Field trip enables students to discover and explore new information and also apply previous knowledge by acquiring concrete examples. Field trip is a teaching method that the teacher uses to arouse the interest of the students, thereby helping the students to gain direct experience (Behrendt & Franklin, 2014).

Field trip is an interactive strategy of teaching that gives male and female students' equal opportunity to widen their practical and cultural experiences by changing their learning environment (Okolie, Igwe, Mong, Nwosu, Kanu, & Ojemutide, 2023). Gender is a social or cultural characteristic known in the society therefore, male and female students are important in

the academic sector because they both strive together. Gender is one of the factors that may influence students' academic achievement in science and calls for research review from time to time (Umanah, 2024; Sunday & Edet, 2024). Gender is a psychological term describing behaviour and attributes expected of individuals on the basis of being male or female (Umanah & Sunday, 2022, Umanah & Akpan, 2024). Itighise (2016) indicates that female students maintain high positive behaviour when using innovative methods in learning than male. Gender has a great disparity in determining sex related difference in students' academic achievement in Biology. Charlotte, Charles and Loius (2023) upheld that at secondary level, even though boys and girls have the same access to course work, they do not emerge with the same level of understanding due to lack of life experiences and ability to participate actively in class.

Expository method is the most commonly used method of teaching science. Expository method is a teacher-controlled and information-centred approach in which the teacher serves as a sole resource in classroom instruction (Marmah, 2014). In other words, the teacher talks and the students become passive learners. Expository method is one way flow of communication from the teacher to the students. Expository method helps students to develop and improve the ability to listen attentively to the teacher but it reduces students' initiatives as it makes them passive learners (Mohammad, Bala and Ladu, 2016). In enhanced conventional expository method (conventional expository method + power point), learning tasks are presented through: daily review (the objective of the lesson and duration of the lesson explained), brief introduction, lesson demonstration using power point presentation, oral review, evaluation (through questioning) and home work / assignment (Babayemi & Ahmed 2019).

Alhaji, Sylvanus, Adekunle, Emmanuel, John, & John, (2020) noted that regardless of the high number of students in Senior Secondary School Examination conducted by WAEC and NECO, achievement in external examination is still poor and this could be as a result of expository method used by teachers in teaching senior secondary school Biology. It is against this background that the researchers examined the use of teaching methods andBiology students' academic achievement in Eket Federal Constituency.

Statement of the Problem

One of the main problems facing most secondary schools in Nigeria today is a decline in academic achievement of students, especially in Biology. The academic achievement of students in Biology depends on how the teacher presents the content of the lesson, the teaching materials and the teaching methods used by the teacher to teach various Biology concepts. The teaching of science subjects in schools has not been encouraging due to the abstract nature of the teaching method which is why the teaching method is necessary and needed to facilitate students' learning of Biology. The teaching methods used in the teaching of Biology as a subject in senior secondary school are faced with many problems. The poor academic achievements of students in Biology as indicated in the report of West African Examination Council and National Examination Council has led to a persistent public outcry as regards to the failing standard of Biology. Chief examiner's report on West African Senior School Certificate Examination from 2021 to 2023 showed that the performance of Biology students in 2023 was poor with a raw mean score of 36 and standard deviation of 11.66 of WASSCE 2023.

The West African Examination Council (WAEC) Chief examiner's report of 2023 noted that students' performance in Biology is very poor. The teaching methods commonly used in the classroom have not sufficiently eased the learning process of the subject almost at all levels. The question now is: Can concept mapping and field trip teachingmethods enhance Biology students' academic achievement in Eket Federal Constituency? This study therefore sought to investigate on the comparative effectiveness of concept mapping, field trip and expository teaching methods on Biology students' academic achievement in Eket Federal Constituency.

Purpose of the Study

The purpose of this study is to determine the effect of teaching methods and Biology students' academic achievements and retention in teaching classification of animals in Eket Federal Constituency, Akwa Ibom State. Specifically, this study sought to:

1. determine the difference in the mean achievement scores of Biology students taught the concept of classification of animals using concept mapping, field trip and expository teaching method.
2. determine the difference in the mean achievement scores of male and female Biology students taught the concept of classification of animals.

Research Questions

The following research questions raised to guide the study;

1. What is the difference in the mean achievement scores of Biology students taught the concept of classification of animals using concept mapping, field trip and expository teaching method.
2. What is the difference in the mean achievement scores of male and female Biology students taught the concept of classification of animals.

Hypotheses

To guide the study, the following null hypotheses were formulated and tested at 0.05 level of significant.

1. There is no significant difference in the mean achievement scores of Biology students taught the concept of classification of animals using concept mapping, field trip and expository teaching method.
2. There is no significant difference in the mean achievement scores of male and female Biology students taught the concept of classification of animals.

Methodology

The research design adopted for this study was pretest, posttest, non-equivalent control group quasi-experimental design which involves the use of intact classes and non randomization. The study was carried out in Eket Federal Constituency, Akwa Ibom State, Nigeria. Eket Federal Constituency is made up of four Local Government Areas (Eket, Onna, Esit-Eket, Ibeno). Eket Federal Constituency is located in the South-South geopolitical zone. The population of the study comprised 2,829 senior secondary one (SS1) Biology students in twenty-three (23) public co-educational secondary schools in Eket Federal Constituency, Akwa Ibom State for 2023/2024 session. The sample size for the study consisted of one hundred and fifty (150) SS1 Biology students selected from three (3) intact classes from three (3) co-educational public schools in the area. Multistage sampling technique was used to select a sample size of one hundred and fifty (150) senior secondary one (SS1) Biology students for the study.

Stage 1: The researcher selected three out of four local government areas within the federal constituency which involved clustering the population into manageable groupd and randomly selecting a subset.

Stage 2: Within the selected three local government area, the researcher identified nineteen schools and then selected three co-educational schools from these nineteen using stratified sampling technique to ensure representation from each local government area.

Stage 3: The researcher assigned the three schools to experimental group one, two and the control group using balloting method of simple random sampling technique.

Four instruments were used to collect data for the study; these wereBiology Achievement Test (BAT), Instructional package on classification of animals using concept mapping teaching method, Instructional package on classification of animals using field trip teaching method,

Instructional package on classification of animals using Expository method. Biology Achievement Test (BAT) were in two sections A and B. section (A) contained students' personal data (sex and location) and section (B) contained a fifty (50) multiple choice items. Each item has four (4) options with only one correct answer. The test was used to gather the scores for pretest and posttest of students on the concept of classification of animals in Biology when taught using concept mapping, field trip methods and expository method.

Concept mapping lesson package was used by the teacher to explain the concept of classification of animals to the students in experimental group one, field trip lesson package was used for group two and expository methodlesson package was used as control group. The draft of the research instrument were given to an expert in Measurement and Evaluation in the Department of Science Education, Akwa Ibom State University, and two independent assessors (two Biology teachers who have marked WAEC for at least five years) to scrutinize. The advice of these experts helped to modify the set of test items which was used for data collection. The content validity of the Biology Achievement Test (BAT) was ensured using test blue print. Questions were based on low order cognitive domain (knowledge, Comprehension and Application) and high order cognitive domain (Analysis, Synthesis and Evaluation). The reliability of the research instrument was determined using Kuder-Richardson's formula 20 (KR-20) and a reliability coefficient of 0.85 was obtained. Each question of the multiple choice objective Biology Achievement Test (BAT) when answered correctly attracted two (2) mark and an incorrect answer attracted zero mark. Maximum score was 100 marks while minimum was zero marks. Relevant permissions were obtained from the school principals, Biology teachers as well as the students in each school selected.Mean and standard deviation were used to answer research questions while Analysis of Covariance (ANCOVA) was used to test all null hypotheses at 0.05 levels of significance.

Results

Research Question One: What is the difference in the mean achievement scores of Biology students taught the concept of classification of animals using concept mapping, field trip and expository teaching methods?

Table 1: Mean and standard deviation of mean achievement scores of students on pretest posttest based on teaching methods.

TeachingMethods	N	Pretest		Posttest		Mean
		Mean	SD	Mean	SD	Difference
Concept Mapping	50	30.40	7.95	65.20	11.94	(5.5)(19.08)
Field trip	50	31.68	8.92	59.70	16.94	(-5.5)(13.58)
Expository	50	29.32	6.54	46.12	11.42	(-19.08)(-13.58)

Table 1 reveals that the pretest mean scores of students taught the concept of classification of animals using concept mapping, field trip and expository teaching methods are 30.40, 31.68 and 29.32 with standard deviationof 7.95, 8.92 and 6.54 respectively. The posttest mean scores accordingly were 65.20, 59.70 and 46.12 with their standard deviation scores of 11.94, 16.94 and 11.42 respectively. The result also shows a posttest mean difference in achivment score is 5.5. for concept mapping and field trip, 19.08 for concept mapping and expository and 13.58 for field trip and expository teaching methods. This mean difference in achievement scores shows that students taught with concept mapping achieved higher than those taught with field trip and expository methods.

Research Question Two: What is the difference in the mean achievement scores of male and female biology students taught the concept of classification of animals.

Table 2: Mean and standard deviation of mean achievement scores between male and female students on pretest posttest scores

Gender	N	Pretest		Posttest		Mean Diff.
		Mean	SD	Mean	SD	
Male	62	30.06	7.72	57.48	17.39	0.39
Female	88	31.14	9.04	57.09	15.84	

Table 2 shows the result of pretest and posttest mean achievement of biology students based on gender. The result reveals that the pretest mean for male and female taught the concept of classification of animals are 30.06 and 31.14 as well as standard deviation of 7.72 and 9.04 respectively. The posttest mean for male and female taught the concept of classification of animals are 57.48 and 57.09 with standard deviation of 17.42 and 15.84 respectively. The mean difference in the posttest mean score for male and female students is 0.39. This implies that male students taught the concept of classification of animals achieved slightly better than the female counterparts.

Hypothesis One: There is no significant difference in the mean achievement scores of biology students taught the concept of classification of animals using concept mapping, field trip and expository teaching methods.

Table 3: Result of Analysis of Covariance (ANCOVA) on the difference in the mean achievement scores of biology students based on teaching methods

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	10302.495[a]	3	3434.165	16.721	.000
Intercept	22806.360	1	22806.360	111.043	.000
PreBAT	486.322	1	486.322	2.368	.126
Teaching_Methods	9601.185	2	4800.593	23.374*	.000
Error	29985.878	146	205.383		
Total	531980.000	150			
Corrected Total	40288.373	149			

a. R Squared = .256 (Adjusted R Squared = .240); *significant at the 0.05 level significance

Table 3 presents the result of Analysis of Covariance (ANCOVA) on the difference in the mean achievement scores of biology students taught the concept of classification of animals using concept mapping, field trip and expository teaching methods. The above result shows that there is significant difference in the mean achievement scores of biology students taught the concept of classification of animals using concept mapping, field trip and expository teaching methods $\{(F_{2, 146}) = 23.374, P=0.000\}$ for teaching methods. Since p is lesser than 0.05 level of significance, the null hypothesis one of this study is therefore rejected. To determine the direction of difference the result was subjected to Scheffe Poc Hoc test as shown in table 4 below.

Table 4: Post Hoc Test Multiple Comparison of the Differences in the achievement among the Groups due to methods

(I) Teaching Methods	(J) Teaching Methods	Mean Difference (I-J)	Std. Error	Sig.
Concept Mapping	Field Trip	4.5600	2.87954	.288
	Expository Method	18.9800*	2.87954	.000
Field Trip	Concept Mapping	-4.5600	2.87954	.288
	Expository Method	14.4200*	2.87954	.000
Expository Method	Concept Mapping	-18.9800*	2.87954	.000
	Field Trip	-14.4200*	2.87954	.000

*significant at the 0.05 level significance

Table 4 show the Post Hoc Test to determine the direction of difference among the mean achievement scores of students taught the concept of classification of animals using concept mapping, field trip and expository teaching methods. The result shows a mean difference of 4.5600 at (p=.288) between students taught using concept mapping and field trip teaching methods. This result indicates that there is no significant difference in the mean achievement scores of students taught the concept of classification of animals using concept mapping and field trip teaching methods. The result also shows a mean difference of 18.980 at p=0.000 between students taught using concept mapping and expository teaching methods. This results signifies that there is a significant difference in the mean achievement scores of students taught the concept of classification of animals using concept mapping and expository teaching methods in favor of concept mapping. Lastly, the result shows a mean difference of 14.4200 at (p=.000) between students taught using field trip and expository methods. This indicates that that there is a significant difference in the mean achievement scores of students taught the concept of classification of animals using field trip and expository teaching methods in favor of field trip teaching method.

Hypothesis Two: There is no significant difference in the mean achievement scores of male and female biology students taught the concept of classification of animals.

Table 11: Result of Analysis of Covariance (ANCOVA) on the difference in the mean achievement scores of male and female biology students taught the concept of classification of animals

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	718.677[a]	2	359.339	1.335	.266
Intercept	21693.613	1	21693.613	80.591	.000
PreBAT	713.061	1	713.061	2.649	.106
Gender	17.367	1	17.367	.065*	.800
Error	39569.696	147	269.182		
Total	531980.000	150			
Corrected Total	40288.373	149			

a. R Squared = .018 (Adjusted R Squared = .004);

Table 11 shows the summary of result of Analysis of Covariance (ANCOVA) on the difference in the mean achievement scores of male and female biology students taught the concept of classification of animals. The result {$(F_{1, 149})$ = .065, P=0.800} shows that the two groups (male and female) did not significantly differ from one another. Hence, there is no significant difference in the mean achievement scores of male and female biology students taught the concept of classification of animals. This result implies that the null hypothesis two was accepted at 0.05 level of significance.

Discussion of Findings
The analysis of the results on the difference in the mean achievement scores of biology students taught the concept of classification of animals using concept mapping, field trip and expository teaching methods revealed students in concept mapping group has achieved higher than those in field trip and expository method group. The result showed that there is a significant difference in the mean achievement scores of biology students taught the concept of classification of animals using concept mapping, field trip and expository teaching methods. Also, result from Post Hoc análisis further showed that students taught using concept mapping did not differ significantly

with those taught using field trip. However, students taught using concept mapping differ significantly with those taught using expository teaching method. Lastly, students taught using field trip did differ significantly with those taught using expository teaching method. This difference in achievement for concept mapping and field trip could be attributed to the fact that the strategies were student-centered by building on students' previous knowledge and that students' find out knowledge themselves. Hence, the result is in line with Samuel and Eriba (2018) who found that there was a significant difference in the mean achievement scores of students exposed to concept mapping-guided discovery integrated instructional approach and the conventional demonstration method. The result is in line with Iroko and Olaoye (2021) who found thatthere was statistically significant effect of concept mapping on students' achievement in algebra. Also, result is in line with Omeodu and Abara (2018) who found that field trip encourage effective learning and promotes students' achievement.

The analysis of the results on the difference in the mean achievement scores of male and female biology students taught the concept of classification of animals showed that there is no significant difference in the mean achievement scores of male and female biology students taught the concept of classification of animals using concept mapping, field trip and expository teaching methods. This is in line with Sunday and Edet (2024) who reported that gender was no a significant determinant of students' learning outcome. Also, the result is in line with Umanah and Sunday (2022) who found significant influence of gender and students' performance in science. The result further lend credence to Achor and Bileya (2022) who revealed that gender differences are not statistically significant in the mean academic achievement scores for both Concept mapping teaching method and Field trip groups.

Conclusion
Based on the findings of the study, it was concluded that concept mapping and field trip teaching methods significantly improved students' academic achievement in Biology, and that the acdemic achievement of students does not have significant effect on gender but on the teaching methods used by the teacher. Hence, teachers need to use appropriate method in instructional delivery process.

Recommendations
Based on the findings of the study, the following recommendations were made:
1. Biology teachers should adopt the use of concept mapping and field trip teaching methods in teaching various concepts in Biology at senior secondary school levels.
2. Curriculum planners for senior secondary school should incorporate the use of concept mapping and field trip teaching methods in curriculum development.
3. Government of Akwa Ibom State should provide recreational parks were students can be taken for field trips to visualize materials and real objects related to concept of classifification of animals as well as other concepts in Biology.
4. Government of Akwa Ibom State should provide functional resource centres were students and teachers can extract materials for concept mapping.

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