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Effect Of Guided Inquiry And Demonstration Teaching Methods On Biology Students' Performance In Obio/Akpor, Rivers State

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ABSTRACT
This paper investigated the effect of guided inquiry and demonstration teaching methods on Biology students' performance in Obio/Akpor local government area, Rivers state. Five research questions and five hypotheses guided the study. The study which adopted a quasi-experimental design specifically non-equivalent control group, was conducted in three randomly selected public secondary schools in Obio/Akpor Local Government Area of Rivers State. The sample comprised of one hundred and fifty (150) students from senior secondary school one (SS1) Biology students. The instrument used for data collection was Biology Performance Test which was developed by the researcher and subjected to face and content validity. The reliability of the Biology performance test was established using Kuder-Richardson formula 20 (KR20) and 0.71 was obtained. Mean and standard deviation were used to answer the research questions while Analysis of covariance was used in testing the hypotheses at 0.05 level of significance. The result of the study revealed that both guided inquiry and demonstration teaching methods brought about a positive academic performance of SS1 students. Based on these findings, it was recommended that guided inquiry and demonstration teaching methods should be adopted by Biology teachers since the methods proved effective in enhancing students' academic performance; teachers should be upgraded on the use of innovative teaching methods through workshops or seminars for the improvement of Biology education in secondary schools among others.
Keywords: Investigation, Guided Inquiry, Demonstration, Performance, Teaching Method.

INTRODUCTION

For an accelerated development in this era, there is need for the implementation of Science Education in the classroom. Science Education according to Dabah (2017), is the study of the connection between science as a discipline and the application of educational principles to comprehend science and learning in the classroom. Science Education can also be seen as the process of imparting knowledge, skills and values that enables individuals to understand and appreciate scientific concepts, principles and theories (Ojo, 2019). Science education equip students with certain basic knowledge, skills and attitude needed for future work in science.

Science is an organised body of knowledge in form of concepts, laws, theories and generalisations. Ubong (2016) defined science as a study of nature and natural phenomena in order to discover the principles and laws guiding nature. Science involves observing, classifying, experimenting, measuring,

inferring, organizing data and so on. Science is a dynamic human activity which is concerned with the working of transforming the society. Science is made up of so many branches of which Biology is an important part of it.

Biology is the study of plants and animals (Michael, 2018). Biology is a natural science concerned with the study of life and living organisms including their structure, function, growth, origin, evolution, distribution and taxonomy. Biology is among the science subject taken in Senior Secondary Certification Examination (SSCE). Most students view Biology as the easiest science subject when compared with other science subjects like Chemistry or Physics but still they perform poorly in Biology external examination (Chukwu & Arokoyu 2019). Performance can be seen as the level of a student's success in learning the subject matter in schools that are expressed in the form of scores obtained from the results of tests on a particular subject matter (Muhibin, 2008).The most contributing factor which causes poor performance of students is the teacher's method of teaching.

In other to improve students' academic performance in Biology, there is need for a learner's centred teaching method; hence the topic effect of guided inquiry and demonstration teaching method on Biology students' performance. The Guided inquiry is a typical example of student centred approach. Guided inquiry is an activity oriented approach to learning where learners are closely monitored by their teacher to find solution to instructional problems through investigation. Guided inquiry method gives the students an in depth understanding of concept or subject. Other than guided inquiry method, there is another method of teaching which promotes science activities as students observes the teacher demonstrate and they practice.

A demonstration involves showing, doing and telling the students the points of emphasis. Demonstration as a teaching method involves showing students how they can carry out particular activities or do certain things through illustration of concepts and ideas by the teacher. Demonstration method provides student with concrete and realistic picture of material to be learnt. It also helps to create a high degree of attention, concentration and interest.

Statement of the Problem

There has been a decline in students' achievement in Biology School Certificate Examinations over the years (evidence from West African Examination Council's Chief examiners' report 2020) and this could be attributed to some factors of which the teacher's method of teaching is an integral part of. Some teaching methods employed by teachers has led to abstractness of Biology thereby making the students less active and encouraging them to engage in rote memorization. Biology is an important science subject, although verse in content, it is very interesting and engaging when taught with teaching methods which allow students to be actively involved in instruction. It became necessary and very important to investigate the effect of guided inquiry and demonstration teaching methods and how they can be used in order to improve students' performance in Biology.

Aim and Objectives

This paper intended to ascertain the effect of guided inquiry and demonstration teaching methods on students' performance in Biology. Specifically, the study sought to;

1. determine the effect of guided inquiry teaching method on students' performance in Biology.
2. investigate the effect of demonstration teaching method on students' performance in Biology.

Research Questions

The following research questions guided the study;

1. What is the mean performance scores of students taught Biology using guided inquiry teaching method and those taught using conventional lecture method?
2. Is there any difference in the mean performance scores of students taught Biology using demonstration teaching method and those taught using conventional lecture method

Hypothesis

This paper has one hypothesis which was tested at 0.05 level of significance

1. There is no significant difference in the interaction effect of students' taught Biology using guided Inquiry and demonstration teaching methods.

LITERATURE REVIEW

Biological knowledge is an essential element for national development. Biology Education entails the application of principles of education in teaching and learning of Biology. Biology education helps to promote individual's understanding of man's relationship with the environment as well as knowledge of the relationship existing between living and non-living things that abound in the environment. It helps to prepare individual for vocation such as Pharmacy, medicine, agriculture, nursing, teaching etc. There are some Challenges associated with the teaching of Biology Education in Nigeria; Security issues in Nigeria has been worrisome. Homes, schools, churches, farms etc are being attacked especially in the Northern part of Nigeria. Lecturers, teachers and students are also in danger as they are being kidnapped and killed. The resultant effect of these are also on education. These are students who could have become renowned Biology Educators (Aina, 2018). Furthermore there is no adequate fund for the provision of conducive and enabling environment to facilitate effective teaching and learning of Biology as well as research. Finally, some method of teaching employed by some teacher doesn't encourage students' active participation. The solutions to these challenges could be; Biology teachers should be sponsored for seminars, conferences and workshops so as to encourage them and also to update their knowledge, Government should increase funding in education sector particularly Biology in order to meet up with demands in terms of infrastructure.

Methods of Teaching Science

There is no one good method of teaching. The method to be used should depend on the subject matter, learners, the teacher and environmental factors. The Lecture method is a teacher-centred method of teaching; Psychomotor skill is developed hence fast note taking is involved. there is more of spoon feeding the learner with information. It does not allow active participation by the learners.

Guided Inquiry Method

Guided inquiry is an instructional strategy that provide the learners with information and uses teacher's guidance to help them process that information in abstraction (Nwanekezi & Ugonwa 2021). It is also an activity oriented approach to learning where learners are closely monitored by their teacher to find a solution to instructional problems through investigation. The guidance and direction provided by the instructors ensures success in the discovery of concepts and principles. Guided inquiry encourages active learning, as students are actively involved in the process of discovering information. This can lead to a deeper understanding of the subject matter. This can lead to a more enjoyable and rewarding learning experience (Karaarslan, 2020).

Demonstration Method

Demonstration involves showing, doing and telling the learners' the points of emphasis. It is mostly used within a method of teaching and sometimes as a method by itself. It is used as an exhibition lesson, more so, to show parts or correct use of equipment (Nwanekezi & Ugonwa 2021). Demonstration as a teaching method is an instructional method that has its link between explanation and practice, where the teacher demonstrates an experimental activity in a functional Biology laboratory while the learners watch (Blair et al 2017). The teacher demonstrates a procedure with clarification where necessary and then learners observe and then repeat theirs. Demonstration method is the one of the best methods for teaching sciences as it heighten the development of skills and adeptness in carrying out some distinctive experiment. It also facilitate skill acquisition and leads to in-depth understanding. Guided inquiry and demonstration approaches are based on the philosophical and epistemological ideas of some cognitive theories of Piaget, Dewey, Bruner and Bandura among others.

METHODOLOGY

The study which adopted a quasi-experimental design specifically non-equivalent control group, was conducted in three randomly selected public secondary schools in Obio/Akpor Local Government Area of Rivers State. The sample comprised of one hundred and fifty (150) students from the entire SS1 population of about fourteen thousand seven hundred and five students (14,705) students in all the eighteen public secondary schools in Obio-Akpor Local Government Area senior secondary school one (SS1) Biology students. The sample size of one hundred and fifty (150) was drawn using Taro Yamane

statistical method. The instrument used for data collection was Biology Performance Test which was developed by the researcher and subjected to face and content validity. The reliability of the Biology performance test was established using Kuder-Richardson formula 20 (KR20) and 0.71 was obtained. Biology teachers from each of the selected schools were trained by the researcher to assist in administering the Biology performance test. The Pre-test was administered to intact class in School A. The students were then taught using guided inquiry with the lesson plan prepared by the researcher. Then the treatment was given to the experimental group with guided inquiry. Intact class in school B were taught the same content using demonstration teaching method. The control group (School C) were taught using lecture method but no treatment was administered. Two weeks after, the classes selected were given Post-test. The treatment lasted for four weeks. Mean and standard deviation were used to answer the research questions while Analysis of covariance was used in testing the hypotheses at 0.05 level of significance.

RESULTS

Research question 1: *What is the mean performance score of students taught Biology using guided inquiry teaching method?*

Table 1. Mean and standard deviation analysis showing the effect of guided inquiry method on the mean performance score of students in Biology

Treatment Group	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Mean Gain
Guided Inquiry	46	9.826	2.488	19.04	4.242	9.21
Lecture Method.	54	10.11	2.765	14.81	3.880	4.70

Table 1 presents the results of the effect of guided inquiry strategy and the conventional lecture method on students' performance in Biology. The treatment group that is students taught Biology using guided inquiry had mean gain of 9.21. In contrast, the control group that is those taught using lecture method had mean gain of 4.70.

Based on the table, it can be inferred that the treatment group showed a substantial increase in post-test scores, along with a higher mean gain compared to the control group.

Research question 2: *Is there any difference on the mean performance scores of students taught Biology using demonstration method and those taught using conventional lecture method?*

Table 2. Mean and standard deviation analysis showing the effect of demonstration method on the mean performance score of students taught Biology

Treatment Group	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Mean Gain
Demonstration	50	10.46	2.444	18.76	4.242	8.30
Lecture Method.	54	10.11	2.765	14.81	3.880	4.70

Table 2 presents the results of the effect of demonstration method and the conventional lecture method on students' performance in Biology. The treatment group that is students taught Biology using demonstration teaching method had a mean gain of 8.30 points. In contrast, the control group that is traditional lecture teaching method had a mean gain of 4.70.

Based on the table, it can be inferred that the demonstration method had a significantly positive effect on students' performance in Biology with a higher mean gain compared to the control group.

Hypothesis: There is no significant difference in the interactive effect of students taught Biology using guided Inquiry and demonstration teaching methods on their performance scores

Table 3: ANCOVA analysis showing significant difference in the in the effects of students taught Biology using guided Inquiry and demonstration teaching method on their performance scores.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	830.480[a]	3	276.827	21.963	.000	.311
Intercept	1370.739	1	1370.739	108.753	.000	.427
Mean Scores	252.968	1	252.968	20.070	.000	.121
Groups	577.918	2	288.959	22.926	.000	.239
Error	1840.213	146	12.604			
Total	48224.000	150				
Corrected Total	2670.693	149				

The table 3 shows that the computed F (1, 146) = 22.926 P <.05, i.e. p = .000 is statistically significant at the chosen alpha level of 0.05. Therefore, there is a significant effect in the mean performance scores of students taught using demonstration method and those taught using inquiry methods as F (1, 146) = 22.926 P <.05, i.e. p = .000. The null hypothesis of no significant difference in the effects of students taught Biology using guided Inquiry and demonstration methods on their performance scores is rejected and the alternate accepted, this implies that the difference that exists between these two groups (Students taught using demonstration strategy and those taught using guided inquiry method) is statistically significant.

DISCUSSION

The results of this finding in research question one reveals that students taught Biology using guided inquiry method performed better than those taught using conventional method. The result of the findings is in line with the views of Ndukwe (2021), Alabi and Lasisi (2015) who revealed in their separate findings that Guided inquiry strategy is the most effective in enhancing learning of science subject than the conventional lecture method.

Based on the findings, the result in research question two showed that students taught Biology using demonstration method performed better than those taught using lecture method. This result supports the findings of Musa (2017), that apart from remedying students' misconception, demonstration teaching strategy enhances students' academic performance. The findings in hypothesis one showed F(1,146) =22.926 P<.05 i.e P=.000. The null hypothesis of no significant difference in the effect of students taught Biology using guided inquiry and demonstration methods on their performance scores is rejected and the alternate accepted, this implies that there is a significant difference between students taught Biology using guided inquiry and those taught using demonstration teaching methods. This findings is in line with the views of Ndukwe (2021) and Musa (2017) in their separate works that guided inquiry and demonstration teaching strategy enhances students' academic performance.

CONCLUSIONS

Students' taught Biology using guided inquiry and demonstration method performed better than those taught using conventional lecture method. Inquiry and demonstration goes beyond the simple memorization of facts but into the realm of creating new and deeper understanding through identification and subsequent application of solution to a specific topic. Students taught with both method had a high mean gain.

RECOMMENDATIONS

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

1. Biology teachers and educators should adopt the guided inquiry and demonstration teaching methods as both help improve students' performance in Biology.

2. Ministry of Education and relevant academic bodies like Science Teachers association of Nigeria (STAN) should enlighten teachers on how well to use the guided inquiry and demonstration teaching methods through organized in-service trainings workshops and seminars.
3. The federal and State Ministries of Education should encourage Biology textbook writers to write and publish Biology textbooks based on the inquiry and demonstration teaching methods.

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