

An Assessment of Inquiry and Lecture Methods on the Academic Performance of Undergraduate Biology Students in Zaria, Kaduna State

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Abstract

This study assessed the impact of Inquiry and Lecture methods on Performance of Undergraduate Biology Students' in Zaria, Kaduna State. Two objectives, two research questions and two null hypotheses guided the study. The study adopted quasi experimental research design. The population of this study comprised of 135 all four (4) hundred level undergraduate Biology students in Federal College of Zaria, Kaduna State, Nigeria. A sample of (100) one hundred Biology undergraduate students was purposively sampled from the entire 135 Biology students in Federal College of Zaria, Kaduna State, Nigeria. The instrument used for data collection was a multiple-choice objective test titled "Biology Inquiry Performance Test (BIPT)". The instrument was validated by Senior lecturers in department. The reliability of the instrument was pilot tested using a test/retest method. The reliability coefficient of the test/re-test scores was computed by means of Pearson Product Moment Correlation Coefficient (PPMCC) and a reliability value of 0.849 was obtained. The data was collected through the administration of pre-test and post-test. The bio data of the respondents was analyzed using descriptive statistics which involves frequencies and percentages while mean and standard deviation were used to answer the research questions. Independent t-test was used to test all the hypotheses at 0.05% level of significance. Findings of the study showed among others that students taught Biology using Inquiry method performed far better than those taught using conventional method in Federal College of Education, Kaduna State, Nigeria. Zaria (.000 <0.005). Students taught Digestive System in Biology using inquiry method performed far better than those taught using conventional method in Federal College of Education, Kaduna State, Nigeria (.001 <0.005). Recommendations were made to include that teachers should use guided inquiry in teaching Biology more than unguided inquiry since the method has proved effective in enhancing students' academic performance in Biology. And that Ministry of Education and relevant academic and professional bodies like Science Teachers Association of Nigeria (STAN), NERDC, NTI and Teachers Registration Council of Nigeria (TRCN) should enlighten teachers on the use of inquiry teaching methods through organized in-service trainings, workshops and seminars.

Keywords: Inquiry, Lecture Methods, Academic Performance, Undergraduate, Biology.

Introduction

Science is a particular way of looking into the world and coming up with broad explanations for why things occur after looking at specific circumstances. (Mader, 2010; Ajaja, 2017; Johnson & Raven, 1998). The majority of modern technical advancements are founded on

the backbone of science. Nigeria and other countries are working hard to advance their science these days since science is becoming more and more important to the proper functioning of all aspects of life (Mader, 2010). Alebiosu (2013) asserts that the goal of science is to discover the reasons behind events or experiences in life. According to Oyewole (2013), some people see science as a tool or a means for a country's technical and economic progress.

Obioma (2018) declared that every learner who has gone through nine years of basic education should have acquired appropriate levels of literacy, numeracy, manipulative, communicative, and life skills, as well as the ethical, moral, and civic values needed for laying a solid foundation for life-long learning as a basis for scientific and reflective thinking. According to the definitions, science involves more than just acquiring facts; it also involves students actively participating through activity-based teaching strategies such as discussion techniques, project methods, field trips, and inquiry-based instruction. Thus, Kaduna State's Zaria evaluated the effects of the inquiry and lecture methods on the performance of undergraduate biology students.

The study of life and living things, including their structure, function, growth, evolution, distribution, and classification, is the subject of biology, a branch of natural science (Aquarena Wetlands Project, 2014). Biologists investigate the composition, process, development, origin, and distribution of biological things (Bagley, 2014). The fundamental building block of life is the cell; the fundamental building block of heredity is the gene; and the fundamental driving force behind the synthesis and development of new species is evolution. Contemporary biology is a large and varied science. Today, it is also recognized that all living things depend on the consumption, transformation, and regulation of energy in order to maintain a stable and healthy condition. Nwagbo and Chikelu (2011) also concurred that governments rely on science as a significant enterprise in order to grow technologically. So, due to its importance and relevance to life and society, science is given a lot of attention in education.

Biology is a subfield of science and a requirement for several academic fields. It makes a big difference in the technological progress of the country. Students' attitude, interests, and performance in biology at the West African Examination Council (WAEC) have not been promising, despite the significance of biology in nation building (Iliyasu, 2016). By assuming the role of a scientist, inquiry enables students to learn about and engage with biology directly. The students combine what they already know with what they have learned to generate explanations from their observations (evidence) through the inquiry method (Opara, 2011).

The goal of education, according to the National Strategy on Education (FRN, 2013), is to encourage children to be creative and curious through outdoor adventure. James (2020) says that the goals of the National Policy on Education will not be met as planned if proper teaching methods and the idea that people are different are not closely watched. According to these goals, Biology, Chemistry, and Physics are the three main science disciplines taught at the Senior secondary school level in Nigeria. All science students in senior

secondary school in Nigeria are required to take biology, which is one of the core science subjects.

The lecture approach is one of the most popular ways to teach science in senior secondary schools. This is a teaching strategy that, in accordance with Bichi (2002), stresses "talk and chalk" when it comes to the teaching of science subjects. More than 80% of scientific knowledge and ideas are communicated orally in lectures. Teachers make use of this strategy because it makes covering the curriculum simple. A one-way information flow from the constantly engaged teacher to the perpetually inert students distinguishes it. The lecture method is inherently ineffective for teaching science. It does not encourage meaningful learning, according to Bichi (2002), Usman (2020), and James (2020). They went on to say that rote learning occurs when science is taught via the lecture technique. When the lecture method is applied, Achilles and Pate (2012) found that skill acquisition increases. To effectively teach and learn biology, however, the lecture mode of instruction must be improved, not entirely abandoned. Use of inquiry-based instruction can achieve this.

The inquiry method of teaching is a way of teaching that encourages students to find their own answers by doing thorough research, with little help from the teacher (Adedoyin, 2020). "Inquiry" is a word that science teachers often use to describe a way to ask questions, look for knowledge or information, or learn about something. Students who use this method learn not only facts and ideas, but also self-discipline, accountability, and how to get along with others. It is a step-by-step method that is very interesting and works with students at all levels of conversation (Obeka, 2010). When people are left alone, that is also how they learn.

Based on the above explanations, inquiry-based teaching can also be seen as a way to teach that encourages students to look at academic material by asking questions about problems they have found and giving answers to those questions. This method, which is often referred to as problem-based education or plain "inquiry," centres the curriculum around the students' questions and gives just as much weight to research-related abilities as it does to topic knowledge and understanding.

Performance refers to accomplishment or proficiency in an area of knowledge or skill. According to Ricarda (2015), academic performance is the result of educational output and measures how well an individual has achieved particular objectives that were the focus of activities specifically at school, college, and university. Academic performance, according to Popoola (2010), is an expression used to describe a student's academic standing and is dependent on a number of variables, including the teacher's method, training, the child's upbringing, the school's climate, the student's attitude, and their interests.

Statement of the Problem

The persistently subpar biology performances of students served as the impetus for this investigation. Perhaps some of this can be attributed to the poor teaching and instructional strategies used by biology teachers. According to Marakinyo (2009), teachers' failure to use verbal reinforcement and inquiry-based teaching strategies is to blame for the decline in

academic performance. According to Opara (2011), inquiry education, whether it be led or unguided, can ultimately and favourably impact students' comprehension, success, and interest in biology. Although it is extremely scientific in character, the inquiry teaching technique was chosen for this study because it is rarely used in our tertiary institutions (Sola & Ojo, 2007). Finding the source of this issue is the first step in trying to find a solution to poor biology performance. It has been demonstrated that the issue of subpar performance can be reduced if the appropriate method or methods are employed when teaching biology (Heeman, 2005; Bryan, 2007). Yet, the percentage of secondary school students who fail scientific classes, particularly biology, has taken on a grave dimension.

This, to the researcher, does not provide a good way for students to learn, most especially as was observed by John (2009), who said that biology is not a subject that can be mastered by mere memorization of the basic rules. It requires total involvement of the learners in the learning process, sound theoretical knowledge, and intensive practise in the application of basic principles. It is as a result of these problems that the researchers were prompted to carry out an investigation to assess the effects of inquiry methods in teaching biology.

Objectives of the Study

This study was carried out with the objectives to:

- i. determine the performance of students taught Biology using inquiry method and those taught using conventional method in Federal College of Zaria, Kaduna State, Nigeria.
- ii. examine the academic performance of students when taught Digestive System in Biology using inquiry and conventional methods in Federal College of Zaria, Kaduna State, Nigeria.

Research Questions

The following research questions were raised to guide the study:

- i. What is the performance of students taught Biology using Inquiry and conventional methods in Federal College of Zaria, Kaduna State, Nigeria?
- ii. What is the performance of students taught Digestive System in Biology using inquiry and conventional methods in Federal College of Zaria, Kaduna State, Nigeria?

Research Hypotheses

The following null hypotheses were formulated and tested in the course of this study:

Ho₁: There is no significant difference in the performance of students taught Biology using inquiry and those taught using conventional methods in Federal College of Zaria, Kaduna State, Nigeria.

Ho₂: There is no significant difference in the academic performance of students when taught Digestive System in Biology using inquiry and conventional methods in Federal College of Zaria, Kaduna State, Nigeria.

Methodology

The study was conducted using a quasi-experimental design. This implies that the research design used for this study was a pre-test, post-test. In this study, the research design signifies that students in both the experimental group (Inquiry method) and the control group (Conventional method) were exposed to a pre-test using the Biology Inquiry Performance Test (BIPT). After the treatment, the Biology Inquiry Performance Test (BIPT) was rearranged alphabetically and administered with a post-test to both the experimental and control groups in their respective schools.

The population of this study comprised 135 (400 Level) undergraduate Biology students in Federal College of Zaria, Kaduna State, Nigeria for 2021/2022 academic session. A sample of (100) one hundred Biology undergraduate students was purposively sampled from the entire 135 Biology students in Federal College of Zaria, Kaduna State, Nigeria. One instrument was used for the purpose of data collection: the multiple-choice objective tests titled "Biology Inquiry Performance Test (BIPT)". The reliability of the Biology Inquiry Performance Test (BIPT) was determined by statistical analysis of the data collected from the pilot study. Results of the trial test were recorded in terms of their overall performance on the test and re-test administered. The reliability coefficient of the test and re-test scores was computed by means of Pearson Product Moment Correlation Coefficient (PPMCC). Therefore, the instrument was considered reliable because the reliability index fell between 0.05 and a positive one (+1).

The researcher administered a pre-test to the students in the experimental and control groups, respectively, using an instrument named the Biology Inquiry Performance Test (BIPT) before the commencement of the treatment. Meanwhile, the pre-test scores served as a basis for comparing students' performances in Biology test before treatment. Inquiry method (treatment 1) was carried out for a period of five weeks. The experimental groups were taught using inquiry activities, while the control group was taught using the conventional method by their experienced Biology teachers who were trained by the researcher. After the treatment, a post-test was administered to both the experimental and control groups. The scripts were collected, marked, scored, and recorded to make comparisons between the groups. Both descriptive and inferential statistical techniques were used in the analysis of data. The bio-data of the respondents was analyzed with descriptive statistics, which involved the use of frequencies and percentages, while mean and standard deviation were used to answer the research questions. Significant variations in mean responses from all the test groups were analyzed using an independent sample t-test. All the hypotheses were tested at 0.05 level of significance.

Results and Discussion

Hypothesis One: There is no significant difference in the performance of students taught Biology using inquiry and those taught using conventional method in Federal College of Education Zaria, Kaduna State, Nigeria?

The post-test administered on students were marked, scored and analyzed using independent sample t-test. The summary of the analysis is presented in Table 1:

Table 1: Summary of Independent sample t-test on the performance of students taught Biology using Inquiry and those taught using conventional method in Federal College of Education Zaria, Kaduna State, Nigeria?

Method	N	Mean	SD	t-cal	df	@	t-crit	P value	decision
Inquiry	108	42.14	20.20	5.96	228	.05	1.96	.001	Rejected
Conventional	122	23.13	11.83						

Table 1 revealed the performance of students taught Biology using Inquiry and those taught using conventional methods in Federal College of Education Zaria, Kaduna State, Nigeria? The table shows that the students taught Biology using Inquiry method had the mean score of 42.42 with the standard deviation of 11.78, while the students taught Biology using conventional method had the mean score of 24.79 with standard deviation of 6.27. The t-calculated of 9.68 is greater than the t-critical of 1.96, while the p-value is .000 ($P < 0.005$). The null-hypothesis which states that there is no significant difference in the performance of students taught Biology using inquiry and those taught using conventional methods in Federal College of Education Zaria, Kaduna State, Nigeria rejected. This result therefore suggests that students taught Biology using Inquiry method performed far better than those taught using conventional method in Federal College of Education Zaria, Kaduna State, Nigeria.

Hypothesis Two: There is no significant difference in the performance of students when taught Digestive System in Biology using inquiry and those taught using conventional method in Federal College of Education Zaria, Kaduna State, Nigeria?

The post-test administered on students were marked, scored and analyzed using independent sample t-test. The summary of the analysis is presented in Table 2:

Table 2: Summary of Independent sample t-test on the performance of students when taught Digestive System in Biology using inquiry and those taught using conventional method in Federal College of Education Zaria, Kaduna State, Nigeria?

Method	N	Mean	SD	t-cal	df	@	t-crit	P value	decision
Inquiry	108	42.42	11.78	9.68	228	.05	1.96	.001	Rejected
Conventional	122	24.79	6.27						

Table revealed the performance of students when taught Digestive System in Biology using inquiry and those taught using conventional method in Federal College of Education Zaria, Kaduna State, Nigeria.

The Table shows that the students taught Digestive System in Biology using Inquiry method had the mean score of 42.14 with the standard deviation of 20.20, while the students taught using conventional method had the mean score of 23.13 with standard deviation of 11.83. The t-calculated of 5.96 is greater than the t-critical of 1.96, while the p-value is .001 ($P < 0.005$). The null-hypothesis which states that there is no significant difference in the performance of students when taught Digestive System in Biology using inquiry and those taught using conventional methods in Federal College of Education Zaria, Kaduna State, Nigeria was rejected. This result therefore suggests that students taught Digestive System in Biology using inquiry method performed far better than those taught using conventional method in Federal College of Education Zaria, Kaduna State, Nigeria.

Discussions of Findings

Research question one demonstrated that students taught biology via inquiry fared better than those taught conventionally at the Federal College of Education in Zaria, Kaduna State, Nigeria. The inquiry approach yielded a mean score of 42.42 and a standard deviation of 11.78, while the conventional method yielded 24.79 and 6.27. Inquiry-based biology students had a mean score of 42.42 compared to 24.79 for conventional biology students. The standard deviation at each level shows that students performed differently. Hypothesis one indicated that the t-calculated value of 9.68 exceeded the t-critical value of 1.96, while the p-value was below 0.05. The null hypothesis that 147 students taught Biology via inquiry and those taught conventionally at the Federal College of Education in Zaria, Kaduna State, Nigeria, performed similarly was rejected. So, at the Federal Institute of Education in Zaria, Kaduna State, Nigeria, students taught biology using the inquiry technique did better than those taught conventionally. This verified Mkpa and Njideka (2019) finding shows that guided inquiry students outperform lecture students. Guided inquiry improves biology students' academic achievement more than lectures.

Hypothesis two demonstrated that students taught the digestive system in biology using the inquiry technique outperformed those taught conventionally. The t-calculated value of 5.96 exceeded the t-critical, and the p-value was below 0.05. The null hypothesis, which asserts that there is no significant difference in the performance of students when taught the digestive system in biology using inquiry versus those taught using conventional techniques at the Federal College of Education in Zaria, Kaduna State, Nigeria, was rejected. This implies that students taught the digestive system in biology utilising the inquiry technique fared much better than those taught using the conventional method at the Federal College of Education in Zaria, Kaduna State, Nigeria (Unogu, 2015). Nwagbo and Chukelu (2011) found that practical activity (inquiry) was more effective than lecture in teaching science process skills. So, the inquiry approach is excellent when teaching biology's practical side. According to Ghumdia (2016), the inquiry approach should be used

to study abstract topics in biology because it helps students become problem solvers and improves their biology performance.

Conclusion

This study concluded that it is the teaching method and not the teacher that is the key to the learning of science and that effective learning takes place when the interactive process is one that is best suited to the individual students in terms of learning styles. Students tend to learn concepts in biology and skills, as well as how to solve problems using a practical method. Inquiry-based learning requires the student to do more than just report on a topic. The inquiry method enables the study to go beyond the simple memorization of facts and regurgitation of information and into the realm of creating new and deeper understanding through identification and subsequent application of solutions to a specific topic. This was evident as the findings from this study showed that students taught biology using inquiry-based methods performed far better than those taught using conventional methods at the Federal College of Education in Zaria, Kaduna State, Nigeria.

Recommendations

The following recommendations were made based on the findings from this study that:

1. Teachers should use guided inquiry in teaching Biology more than unguided inquiry since the method has proved effective in enhancing students' academic performance in Biology.
2. Teachers should also use inquiry methods in teaching and learning of Biology as it will help to achieve the national curriculum objectives which is designed to promote student's inquiry spirit and construction of a life-long knowledge needed for national development.
3. Government should ensure adequate provision of science instructional materials like specimen, charts, chemicals and so forth that could aid effective teaching of the practical and abstract aspect of Biology in schools.
4. The Federal and State ministries of education should encourage Biology textbook writers to write and publish Biology textbooks based on the inquiry and demonstration method.
5. Ministry of Education and relevant academic and professional bodies like Science Teachers Association of Nigeria (STAN) and Teachers Registration Council of Nigeria (TRCN) should enlighten teachers on the use of inquiry and demonstration teaching methods through organized in-service trainings, workshops and seminars.
6. Biology teachers should be regularly sponsored to attend on-the-job training and retraining in order to improve on teaching methods in the teaching and learning of Biology in the classroom.

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