
Assessing the Performance of Students Taught Biology Using Inquiry and Demonstration Compared With Conventional Method in Secondary Schools in Federal Capital Territory, Abuja, Nigeria

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ABSTRACT

This study assessed the performance of students taught Biology using inquiry and demonstration compared with conventional methods in Senior Secondary schools in the Federal Capital Territory, Abuja. Specifically, it assessed, students taught Biology using the two methods and also which of the methods performed better. The study was carried out using quasi-experimental research design. The population of the study was the entire 23,422 SSII students drawn from the 56 senior secondary schools in the Federal Capital Territory comprising of 12,350 boys and 11,072 girls studying Biology in the 2015/2016 academic session. Samples of 101 students from two (2) intact classes were purposively drawn for this the study. The instrument titled "Biology Inquiry and Demonstration Performance Test" (BIDPT) was used for data collection. The instrument consisted of fifty (50) multiple-choice objective questions with four (4) options or answers to pick from. The instrument was validated by three experts from the Ahmadu Bello University, Zaria. The reliability of the instrument was determined using test/re-test. The scores of the pilot study were computed by using Pearson Product Moment Correlation Coefficient (PPMCC) and a reliability coefficient of 0.849 was obtained. The data collected in the study were analysed using mean and standard deviation while hypothesis was tested using independent t-test at 0.05 level of significance. The study concluded that, students tend to learn concepts in Biology as well as skills and how to solve problems using demonstration method; and that Inquiry based learning require the student to do more than just report on a topic. Recommendations were made to include that teachers should use inquiry and demonstration method in teaching Biology more than the conventional method since it has proved to be more effective in enhancing students' performance in Biology. And that Ministry of Education, 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 method of teaching Biology.

Keywords: inquiry method, demonstration method, performance, biology, STAN

Biology is a natural science concerned with the study of life and living organisms, including their structure, function, growth, evolution, distribution, and taxonomy (Aquarena Wetlands Project, 2004 in Aniaku, 2012). The importance of Biology in the development

of any nation cannot be underrated especially in Nigeria where the national income rests on petroleum and petrochemical industries.

Inquiry helps students to learn and experience Biology first-hand, by taking on the role of scientist. The student use

Inquiry process to develop explanations from their observations (evidence) by integrating what they already know with what they have learned (Opara, 2011). According to Waddy (2014), the types of Inquiry teaching methods include: confirmation inquiry, structured inquiry, guided inquiry, and open/true inquiry. In addition to the four main types of inquiry known, Victorian Curriculum and Assessment Authority (2017) in Shaibu & Hanga (2018), wrote on a fifth inquiry method called Coupled inquiry which combines a guided-inquiry investigation with an open-inquiry investigation: the teacher chooses an initial question to

investigate as a guided inquiry and students then build on the guided inquiry to develop an extension or linked investigation in a more student-centred open inquiry approach. There are Six Stages of the Inquiry Cycle: (1) Inquisition – stating "what if" or "I wonder" question to be investigated (2) Acquisition – brainstorming possible procedures (3) Supposition – identifying an "I think" statement to test (4) Implementation – designing and carrying out a plan (5) Summation – collecting evidence and drawing conclusions (6) Exhibition – sharing and communication results (Llewellyn, 2002 in Warner & Myers, 2014).

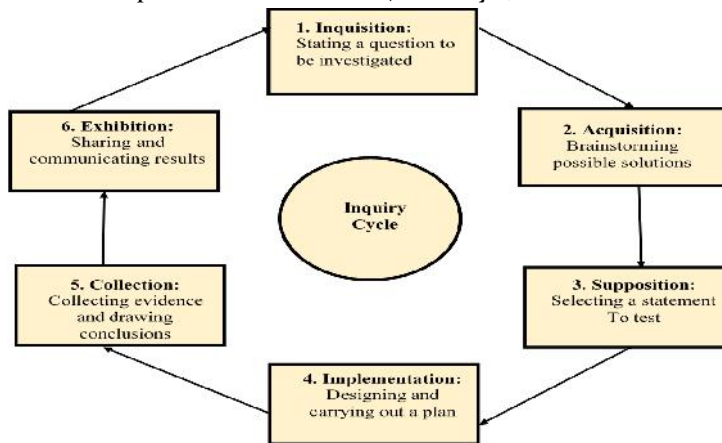


Figure 1: The inquiry cycle: Warner and Myers (2014). Retrieved from <https://edis.ifas.ufl.edu/wco76>

Demonstration is a method in which teachers dramatize topics to be taught by either the use of items or recorded materials, while Students are made to practice the skills demonstrated in readiness for the time they will be asked to display their level of efficiency in the performance of those skills. Teacher-demonstration is a method of teaching whereby all new subject matter is presented and explained by the teacher before it is imitated by students in the class (Aliyu, 2008 in Shaibu (2017). There are three types

of demonstration method namely; step by step, the whole process and spot demonstration (Chikuni, 2003 in Iline, 2013). In the whole process of demonstration, the teacher demonstrates the full process from the beginning to the end without interruption by learners' participation (Chikuni, 2003 in Iline, 2013). Gwarinda (1993) in Iline (2013), the step by step demonstration is done stage by stage with teacher explaining each action as the operation proceeds. The stages are inter-spaced by learner' participation. Spot

demonstration is usually done after the teacher identifies a problem or a mistake being made by the pupils. Petty (2000) in Iline (2013), stated that if the teacher spots a problem, pupils will then be stopped from proceeding with the task. The teacher will have to re-demonstrate the skill. This strategy helps to prevent worsening of the problem.

Anaekwe, Nzelum, Olisakwe and Okpala (2010), in Achimugu (2018), defined lecture (Conventional) method as a process of delivering verbally a body of knowledge according to pre-planned scheme. The lecture method is the easiest, cheapest and can be used to cover the syllabus and teach large groups of students. The authors added that, using this method reduces students to passive listeners and does not encourage the acquisition of critical thinking skills and students' active participation in the lessons. The conventional method was used as a control in this research work.

This study was inspired in response to students' persistent poor performance in Biology which is evident in the West African Senior School Certificate Examination results from 2011 to 2015 for Federal Capital Territory public schools Abuja was 9.2%, 21.4%, 32.2%, 17.7% and 30.2% respectively which reveal very poor performances. NECO/SSCE results from 2011 to 2015 for Federal Capital Territory public schools is 5.7%, 23.4%, 39.0%, 36.9% and 58.7% respectively. These poor performances perhaps can be partly ascribed to inadequate teaching and instructional methods adopted by Biology teachers. As a result of these poor performances, the researcher carried out an investigation to assess the effects of Inquiry and Demonstration compared to the Conventional method of teaching Biology.

Research Question:

In view of the problem identified, this study was guided by this research question: What differences exist in the performance of Students' taught Biology using inquiry and demonstration methods compared to those taught using conventional method in Secondary Schools in Federal Capital Territory, Abuja?

Research Hypothesis

This study tested the hypothesis at 0.05 level of Significance: There is no significant difference in the performance of students taught Biology using inquiry and demonstration methods compared to those taught using conventional method in Secondary Schools in Federal Capital Territory, Abuja.

RESEARCH METHODOLOGY

This research work assessed the performance of students taught Biology using inquiry and demonstration compared with conventional methods in Secondary School in Federal Capital Territory, Abuja. Abuja is the capital of Nigeria, borders on the north with Kaduna State, on south-east with Nassarawa State, on the south-west with Kogi State and on the west with Niger state. This research focused on senior secondary school in which Biology is offered as a subject. Specifically, it assessed which among the students taught Biology using the two methods performed better. The population of this study comprised the entire twenty three thousand, four hundred and twenty two (23,422) SSII students consisting of twelve thousand, three hundred and fifty (12,350) male students and eleven thousand and seventy two (11,072) female students offering Biology in the fifty-six (56) secondary schools in Federal Capital Territory, Abuja 2015/2016 session. A total of one hundred and one (101)

students were used for the study. Fifty one (51) students in Government Secondary School (GSS) Kuje were taught using inquiry and demonstration method while Government Secondary School (GSS)

Gwarinpa was the school used for control group (inquiry and demonstration methods) which comprised of fifty (50) students as seen in the table below.

Table 1: Sample Distribution

S/N	Sampled School	Groups	Male Students	Female students	Total
1.	GSS Kuje	Experimental (Inquiry and demonstration Group)	31	20	51
2.	GSS Gwarinpa	Control Group (Inquiry and Demonstration method)	22	28	50
Total			53	48	101

In administrating the inquiry and demonstration method in the study, topics in the first term SSII Biology Curriculum was taught either using the demonstration or inquiry method in the experimental group while in the control group, students were taught using the conventional method. Digestive system, Respiratory

system, nutrients cycling in nature and Adaptation (Ecological Management) were taught using inquiry method while topics like Transport system and Tolerance (Ecological Management) were taught using Demonstration method as seen in the table below.

Table 2: Treatment Plan for the teaching methods

S/N	Weeks	Topics	Demonstration and Inquiry Method	Convectional Method
1.	Before Treatment			
2.	Before Treatment	Pre-test was administered	Pre-test	Pre-test
3.	Week 1	Digestive System	Inquiry Method	Lecture Method
4.	Week 2	Transport System	Demonstration Method	Lecture Method
5.	Week 3	Transport System - media of transport	Demonstration Method	Lecture Method
6.	Week 4	Transport System - mechanism of transport	Demonstration Method	Lecture Method
7.	Week 5	Respiratory System	Inquiry	Lecture Method

S/N	Weeks	Topics	Demonstration and Inquiry Method	Convectional Method
			Method	
8.	Week 6	Respiratory System	inquiry Method	Lecture Method
9.	Week 7	Excretory system	Inquiry Method	Lecture Method
10.	Week 8	Nutrients cycling in nature	Inquiry Method	Lecture Method
11.	Week 9	Ecological Management: Tolerance	Demonstration Method	Lecture Method
12.	Week 10	Ecological Management: Tolerance	Inquiry Method	Lecture Method
13.	Post Test	After Treatment	Post test	Post test

The teaching of the students using the treatment package lasted for ten (10) weeks. A pre-test which consist of fifty (50) Biology multiple choice objective tests were given to the students before any treatment was administered. The biology tests were designed to measure students' cognitive level and determine the performance of the students in the study. After the treatment to the groups, a post-test was administered to the students. In the post-test, the biology objective test was rearranged to avoid possibility of guessing the answers to the question. Each question will carry 2 marks for a total of 100 marks.

For this study, one instrument was used for the purpose of data collection- the multiple-choice objective tests titled "Biology Inquiry and Demonstration Performance Test" (BIDPT). The instrument consist of fifty (50) multiple-choice objective questions with four (4) options or answers to pick from; which was drawn from the past question papers of WAEC and NECO from 2009 to 2015. The instrument was constructed with the assistance of competent Biology teachers from the six co-educational secondary schools selected. The

reliability of the instrument was carried out using a test/retest on thirty (30) SS II students at Government Secondary School (GSS) Jabi, Abuja. The reliability index was 0.849, computed by means of Pearson Product Moment Correlation Coefficient (PPMCC). The data was collected using means and standard deviation while hypothesis was tested using 0.05 level of significance.

RESULT AND DISCUSSIONS

The summary of the research question and hypothesis tested was presented in table 3 and 4.

Research Question: What differences exist in the performance of students taught Biology using inquiry and demonstration compared to those taught using conventional methods in Secondary Schools in Federal Capital Territory, Abuja?

To answer this research question, the pre-test and post-test results obtained from students were analysed using mean and standard deviation. The summary of the analysis is presented in Table 3:

Table 3: Performance of students taught Biology using inquiry and demonstration compared to those taught using conventional method in Secondary Schools in Federal Capital Territory, Abuja

Method	N	Pre-test Scores		Post-test Scores	
		Mean	SD	Mean	SD
Inquiry and Demonstration	51	32.47	9.02	51.33	10.35
Conventional	50	31.48	9.88	31.54	6.94

Table 3 revealed the performance of students taught biology using both Inquiry and demonstration compared to those taught using conventional method in Senior Secondary Schools in Federal Capital Territory, Abuja. The mean scores as displayed shows that students taught Biology using Inquiry and demonstration methods had a better performance mean scores in their pre-test and post-test. For instance, the mean score of students taught using Inquiry and demonstration methods increased from 32.47 to 51.33 with corresponding standard deviation of 9.02 and 10.35, while the mean score of students in conventional method slightly increased from 31.48 to 31.54 with standard deviation of 9.88 and 6.94 respectively. These shows

that the students' mean score difference is 0.99 and 19.79 in pre-test and post-test respectively. The standard deviation at each level indicated that students' performance varied widely from each other.

Null hypothesis: There is no significant difference in the performance of students taught Biology using inquiry and demonstration compared to those taught using conventional method in Secondary Schools in Federal Capital Territory, Abuja.

The post-test administered on students were marked, scored and analysed using independent sample t-test. The summary of the analysis is presented in Table 4:

Table 4: Summary of Independent sample t-test on the performance of students taught Biology using inquiry and demonstration compared to those taught using conventional method in Secondary Schools in Federal Capital Territory, Abuja

Method	N	Mean	SD	t-cal	df	α	t-crit	P-value	Decision
Inquiry and Demonstration	51	51.33	10.35	11.32	99	0.05	1.96	.000	Rejected
Conventional	50	31.44	6.94						

Table 4 revealed the performance of students taught Biology using inquiry and demonstration compared to those taught using conventional method in Secondary Schools in Federal Capital Territory, Abuja. The table shows that the students taught

Biology using inquiry and demonstration methods had the mean score of 51.33 with the standard deviation of 10.35, while the students taught Biology using conventional method had the mean score of 31.44 with standard deviation of 6.94. The t-calculated

of 11.32 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 demonstration compared to those taught using conventional methods in Secondary Schools in Federal Capital Territory, Abuja was rejected. This result therefore suggests that students taught Biology using Inquiry and demonstration methods performed far better than those taught using conventional method in Secondary Schools in Federal Capital Territory, Abuja.

SUMMARY OF FINDINGS

Findings from the research question showed that performance of students taught Biology using inquiry and demonstration performed better than those taught using conventional methods in Secondary Schools in Federal Capital Territory, Abuja. The students taught Biology using inquiry and demonstration had the mean score of 51.33 with the standard deviation of 10.35 while the students taught Biology using conventional method had the mean score of 31.44 with standard deviation of 6.94 respectively. Students taught Biology using inquiry and demonstration methods had a higher mean score of 51.33 compared to the students taught Biology using conventional method that had a mean score of 31.44. The standard deviation at each level indicates that students' performance varied widely from each other.

Findings from the Hypothesis tested revealed that the performance of students taught Biology using inquiry and demonstration performed better compared to those taught using conventional method in Secondary Schools in Federal Capital Territory, Abuja. The finding showed that the t-calculated value of 11.32 was greater

than the t-critical, while the p-value was less than 0.05 level of significance. The null-hypothesis which states that there is no significant difference in the performance of students taught Biology using inquiry and demonstration compared to those taught using conventional methods in Secondary Schools in Federal Capital Territory, Abuja was rejected. This result therefore affirms that students taught Biology using inquiry and demonstration methods performed far better than those taught using conventional method in Secondary Schools in Federal Capital Territory, Abuja.

DISCUSSION OF FINDINGS

This result of the study which upholds that students taught Biology using inquiry and demonstration methods performed far better than those taught using conventional method in Secondary Schools. It correlates with the findings of Musa (2015) that, demonstration method is significant, but when Inquiry and brainstorming teaching method is used concurrently the performance will be more significant. This study also agrees with Ekeyi (2013), who revealed that demonstration method had significant effect on students' achievement than those taught with the conventional method. Similarly, other studies like Muhammad (2011), Bakke and Igharo (2013); Olibie and Oge (2013); Adejo (2015), revealed that the exposure of students to the inquiry method had better achievement scores, positive attitudes toward learning and that the use of inquiry method enhanced retention. The research work also correlates with findings of Sadeghi, Sedaghat and Ahmadi (2014) that, blended method is effective in increasing the students' learning rate.

CONCLUSION

This study concluded that Inquiry method enables the student 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. The study also affirms that Students tend to learn concepts in Biology and skills and how to solve problems using practical methods (inquiry and demonstration). Inquiry and demonstration methods require the student to do more than just report on a topic, the students learnt to brainstorm possible procedures, design and carry out plans, drew up conclusions before they communicated their results. The use of inquiry and demonstration method, not only impacted in their performance positively, it also aided their presentation skills as a result of the increased confidence. From this study, it is evident that demonstration method of teaching has been proved to be effective as it shows the learners how to do a task using sequential instructions with the end goal of having learners perform the tasks independently. In conclusion, from this study, it showed that students taught Biology using inquiry and demonstration methods performed far better than those taught using conventional method in Secondary Schools in Federal Capital Territory, Abuja.

RECOMMENDATIONS

Based on the findings, the following recommendations were made:

1. Teachers should use inquiry methods in teaching and learning of Biology as it will help to achieve the national curriculum objectives which is designed to promote students inquiry spirit and construction of a life-long knowledge needed for national development.
2. Demonstration method should be adopted by Biology teachers when teaching practical aspect of Biology as this enhances retention.
3. Government and high net worth Individuals should be compelled to ensure adequate provision of science instructional materials like specimen, charts, and chemicals and so forth that could aid effective teaching of the practical and abstract aspect of Biology in schools.

REFERENCES

- Achimugu, L. (2018). Effectiveness of Enriched Demonstration and Lecture Instructional Strategies on Senior Secondary School Students' Achievement in Chemistry. *Journal of Contemporary Education Research*, Vol.2 Issue 1
- Adejo, L. O. (2015). Effects of Inquiry Method on Academic Performance of Chemistry Students in Senior Secondary Schools in Kaduna State, Nigeria. An online Dissertation Ahmadu Bello University, Zaria, Kaduna, Nigeria
- Aniaku, O. L. (2012). *Effects of Guided and Unguided Inquiry Teaching Methods on Secondary School Students' Achievement and Interest in Biology in Enugu State*. M.Ed Thesis University of Nigeria, Nsuka. Retrieved on 21/03/2016@ 3.49pm from <http://www.unn.edu.ng/publications/files/images/Mrs.%20Aniaku%20Obiageli%20Loretta.pdf>
- Bakke, M., & Igharo, O. K. (2013). A study on The Effects of Guided Inquiry Teaching Method on Students Achievement in Logic. *International Researcher* Volume No.2 Issue No. 1

- March 2013. Accessed from www.iresearcher.org on 23/05/2017.
- Ekeyi, N, D. (2013). Effect of Demonstration Method of Teaching on Students' achievement in Agricultural Science. *World Journal of Education*, Vol 3, No 6
- Iline, C. S. (2013). Impacts of the Demonstration Method in the Teaching and Learning of Hearing Impaired Children. *IOSR Journal of Humanities and Social Science (IOSR-JHSS)* Volume 12, Issue 1 (May -Jun. 2013), PP 48-54 e-ISSN: 2279-0837, p-ISSN: 2279-0845. Accessed from <http://www.iosrjournals.org/iosr-jhss/papers/Vol12-issue1/Io1214854.pdf>
- Muhammad, S.L. (2011). *Effects of Inquiry Teaching Method on Academic Achievement, Retention and Attitudes towards Chemistry among Diploma Students of Kano State Polytechnic*. An unpublished M.Ed. Dissertation Ahmadu Bello University Zaria, Kaduna State.
- Musa, O. S. (2015). *Effect of Demonstration and Assignment Methods on Students' Performance in Financial Accounting in Federal Government Colleges in Kaduna State, Nigeria*. Unpublished M.Ed. Dissertation, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.
- Olibie E. I. & Oge, E. K. (2013). Effects of Guided Inquiry Method on Secondary School Students' Performance in Social Studies Curriculum in Anambra State, Nigeria. *British Journal of Education, Society & Behavioural Science*. 3(3):206-222, 2013 SCIEDOMAIN international. www.sciencedomain.org
- Opara, J. A. (2011). Inquiry Method and Student Academic Achievement in Biology: Lessons and Policy Implications. *American-Eurasian Journal of Scientific Research*, 6 (1), 28-31.
- Sadeghi, R. A., Sedaghat M. M., & Ahmadi F.S. (2014). Comparison of the effect of lecture and blended teaching methods on students' learning and satisfaction. *Journal of Advances in Medical Education & Professionalism*. 2014 Oct; 2(4): 146-150
- Shaibu, S.T. (2017). *Assessment of the Effects of Inquiry and Demonstration Methods on Performance of Biology Students' in Secondary Schools in Federal Capital Territory, Abuja, Nigeria*. An unpublished Ph.D Thesis Ahmadu Bello University, Zaria, Kaduna State, Nigeria.
- Shaibu, S.T., & Hanga, S.S. (2018). Assessing the Performance of Students taught Biology using Inquiry and Conventional Methods in Secondary Schools, Federal Capital Territory, Abuja. *International Journal for Educational Development (IJED)*, a publication of Faculty of Education, University of Uyo, Nigeria. Vol 21(1), 40-48.
- Waddy, T. (2014). *The Inquiry Method*. Retrieved on 21/4/2016@2.52pm from <http://slideplayer.com/slide/6952259/>
- Warner, J.A., & Myers, E.B. (2014). *Implementing Inquiry-Based Teaching Methods*. Retrieved on 09/03/2016 @ 7.48pm from <https://edis.ifas.ufl.edu/wco76>