

Effect of Activity-Based Instructional Strategy on Senior Secondary Students' Academic Performance in Biology in Pankshin, Plateau State

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Abstract

The study was conducted to investigate the effect of activity-based instructional strategy on senior secondary students' academic performance in Biology in Pankshin, Plateau State. The population of the study comprised all senior secondary school students offering biology and 40 students were randomly selected for the study. The study adopted a quasi-experimental design and employed the use of Osmosis Achievement Test (OAT) as instruments for data collection. Arithmetic mean was used to analyze the data while t-test was used to test hypotheses. The study found out that the use of activities based instructional strategy in teaching biology has significant effect on students' mean achievement test scores in the subject. The result showed that Activity-Based Instructional Strategy had a positive impact on students' performance in biology. The study recommended that Curriculum developers such as Nigeria Educational Research and Development Council incorporate Activity-Based Instructional Strategy into future curriculum design and implementation for biology curriculum, the government and private school owners as well as other stakeholders in the education sector should invest in the provision of facilities and equipment needed for the use of activities based instructional strategy in teaching and school principals should organize internal workshops and seminars to train teachers on utilization and improvisation of means to use activities based instructional strategy in teaching biology and science in general.

Keywords: Academic Performance, Activity-Based Instructional Strategy.

Introduction

Science plays a crucial role in technological advancement and national development. Science therefore, is receiving much emphasis in education because of its significance and relevance to life and society. Science is both a process (scientific method) and a product (knowledge, fact and principles) (Ezeh, 2013). In secondary schools, science encompasses biology, chemistry and physics. The call for improved teaching and learning of Biology in Senior Secondary Schools has proven unsuccessful, possibly due to the disconnection between curriculum planners and implementers. Educators should understand that change in students must be supported by parallel changes in curriculum and instruction. However, it is apparent that many of today's teachers are caught in the midst of a change for which they may not have been prepared for professionally (Dogru and Kalender, 2007).

Biology is the study of living things, focusing on their structure, behavior, distribution, origin, and their relationship with the environment. (American Heritage Dictionary of the English Language 2009). Abugu (2007) stated that biology is natural science in which we study living organisms' plants and animals. The knowledge of biology helps in checking environmental degradation such as desertification, erosion, water hyacinth, land, air and water pollution.

The cardinal objectives of biology education in the National Policy on Education are to prepare students to acquire adequate laboratory and field skills in biology; meaningful and relevant knowledge in biology, ability to apply scientific knowledge to everyday life in matter of personal and community health and agriculture and lastly reasonable and functional scientific attitudes (FRN, 2013). It is pertinent to note at this point that the aims and objectives of Biology, as stipulated in the National Policy on Education cannot be achieved with current use of traditional approach of teaching.

The Nigerian Educational Research and Development Council (2017) as such, what the researcher has been observing in the past two decades of teaching Biology at the Senior secondary school level is usage of Traditional Teaching Method which is mainly Talk and Chalk (conventional teacher centred method). This could be the cause of the poor performance in the Senior Secondary Certificate Examination (SSCE) results. The performance of students in biology science has continued to decline over the years as indicated by SSCE results as shown from 2018-2021 NECO SSCE results. This could be attributed to the fact that students are not getting the concepts due to inadequate teaching and instructional methods adopted by science teachers. Studies by Usman and Shuaibu (2011) point out that most science teachers use traditional method and copying of notes by students. These methods according to Usman and Shuaibu do not allow active students participation in science lessons rather, students memorize, regurgitate facts and concepts without the basic understanding of what it is. The teaching and learning of biology in Pankshin Local Government Area of Plateau State area is not an exception to the rule, there has also been failure in performance of students in Senior Secondary School Certificate in Biology result from 2015 to 2018. There might be other causes such as unqualified teachers and inexperienced ones, over population of classes and ineffective teaching strategies. Therefore, the study is aimed at determining the effect of Activity-Based Instructional Strategy and the Traditional Methods on students' academic performance in biology at the Senior Secondary school level.

Activity-Based Instructional Strategy, which is Student-Centered in nature, invites the student to participate actively in his or her own learning experiences (discussion, debate, role-play and

simulation and scientific process skills which involve manipulation of materials and equipment). The greater the range of decision that students can be involved in, the greater the degree of personal responsibility which they are encouraged to develop, the more likely it is that progression in learning will occur (Roth, Roy & Hurry, 2013). In this method of teaching, all students regardless of their ages must be active, either mentally or physically or both during the entire lesson (Roth, Roy & Hurry, 2013). It encourages hands on discovery, which enhances the development of valuable learning skills through direct experiences (Akale, 2012). During activity based teaching, classroom environment is authentic because it is based on activities planned with the learner's interest in mind. Teacher respects learners by upholding learners' rights to their feelings, ideas and opinions. It gives the learners the opportunity to develop personalities characterized by self-confidence, respect for self and others and active inquiry and creative minds. It is clear that when learners are allowed to inquire, classrooms become alive with human interaction (Brown, 2015). In activity-based classroom, students are at the position of inquirer, not just a receptor of facts and procedures. Students could make significant decisions about their learning (Roth, Roy and Hurry, 2013).

Research has shown that secondary school students find science uninteresting and abstract and as such, hold negative perceptions and attitudes towards science subjects including biology (Aremu, 2010). This is not unconnected with the perception of difficulty emanating from problems they encounter during class instruction. Many biology teachers resort to the use of conventional teaching methods which are learner centred and not adequate in imparting science process skills to students. One of the best ways to understand something is to get one's hands on it, and just like the great philosopher Confucius put it; "I hear, and I forget", I see and I remember", I do and I understand". Activity based curriculum organization according to Ben-Yunus (2018) is a learner centered activity where learners are challenged, through meaningful activities to find solutions to simple problems that are within their range of ability. It is in view of the above background that the study sets out to investigate the impact of activity based instructional strategy on the academic performance of students in Biology in Senior Secondary schools in Pankshin Local Government Area of Plateau state

The teaching and learning of Biology in most classrooms face a lot of problems. Most of the teachers use the Traditional Teaching Method that comprises Talk and Chalk, Note Taking and Memorization. They do not make use of Activity-Based Teaching Strategies, where the learners play an active role in the learning process. This inability of the Biology Teachers in the use of Activity-Based Instructional Strategies might be the cause of poor performance in the subject at both teacher made examinations and Senior Secondary Certificate Examinations (SSCE). Since Biology is an important core science subject in the senior secondary schools, it has been argued that Senior Secondary School students must be well grounded in Biology at an early stage (Olawajun, 2016). Studies by Inekwe (2012), Martins (2014) have shown that Activity-Based which is learner centered is effective in teaching and learning science. Over the last three decades, the framework for understanding the psychological basis of teaching and learning has shifted from teacher-centred to learner-centred teaching and learning where the responsibility is rested on learners for their own learning of science but most teachers prefer to use the Traditional Method and this might have caused the failure in performance. Thus this study is aimed at comparing the mean performance of students taught using the Activity-Based Instructional Strategy and

Traditional Method in order to determine which one is more effective in teaching Biology in Senior Secondary Schools.

Objectives of the Study

The main purpose of the study was to evaluate the impact of activity based instructional strategy on the academic performance of students in Biology in Senior secondary schools in Pankshin Local Government Area of Plateau state. Specifically, the study was designed to achieve the following objectives:

- i. To find out the mean achievement test score of students taught biology using Activity-Based Instructional Strategy on the academic performance of students in Biology.
- ii. To find out the mean achievement test score of students taught biology using conventional method (chalk and talk method) on the academic performance of students in Biology.
- iii. To find out the difference in the mean achievement test score of students taught biology using Activity-Based Instructional Strategy and those taught using conventional method (chalk and talk method).

Research Questions

This research was set to find answers to the following questions:

- i. What is the mean achievement test score of students taught biology using of Activity-Based Instructional Strategy on the academic performance of students in Biology?
- ii. What is the mean achievement test score of students taught biology using conventional method (chalk and talk method)?
- iii. What is the difference in the mean achievement test score of students taught biology using Activity-Based Instructional Strategy and those taught using conventional method (chalk and talk method)?

Research Hypothesis

The null hypothesis was tested during the study.

H₀₁: There is no significant difference between the performance of students taught biology using Activity-Based Instructional Strategy and those taught using conventional methods (chalk and talk method).

Methodology

The research design adopted for this study was quasi-experimental design, which involved treatment group and control group. A quasi-experimental research design is appropriate for this study because it allows the evaluation of the effect of the activity-based instructional strategy on students' academic performance in Biology within a natural classroom setting without random assignment, ensuring practical feasibility and ecological validity. In the quasi-experiment, two different sets of students (experimental or treatment and control groups) were taught diffusion using different approaches of teaching. The experimental group was taught using activity-based strategy, while the control group was taught conventionally.

The study population consists of all Senior Secondary School I (SSSI) students in Pankshin Local Government Area, Plateau State. Pankshin LGA has a total of three thousand three hundred

and thirty-nine (3,339) Senior Secondary School students (Pankshin Area Directorate of Education, 2023). The sample size for the study consisted of forty (40) students selected from GSS Pankshin and GSS Bet, Pankshin. A sample of 20 is selected from each school and further divided into experimental and control groups (comprising of 10 students each). The experimental groups will be Osmosis in biology using activity-based strategy while the control groups will be taught with the traditional approach. The experimental group comprised of 20 male and female students while the control group also comprised of 20 male and female students, making a total of 40 students used for the study.

For this research, the researchers adopted Simple Random Sampling techniques to select the schools used as experimental and control groups because it ensures every individual in the population being sampled has an equal likelihood of being included. Random sampling is the basis of all good sampling techniques and disallows any method of selection based on volunteering or the choice of groups of people known to be cooperative.

The instrument used for data collection was an achievement test. Osmosis Achievement Test (OAT) was constructed by the researcher. OAT contains 20 multiple choice items, each item contained one correct answer and three distracters. The achievement test consists of two sections: Section A, which contains the biodata of respondents, and Section B, which contains the test items. Data was collected from the field under the control and supervision of the researcher through the issuance of achievement test questions to the students after teaching.

The data collected through the achievement test was carefully assembled and the results obtained were systematically and scientifically organized and presented in tables. Arithmetic mean and t-test was used to analyze the achievement test scores. The analysis was done using the Statistical Package for Social Science (SPSS) version 25.

Results

Pre-Test

Table 1: Calculated t- value for control and experimental groups in pre-test

S / N	Group	N	Mean	Standard Deviation	Degree of freedom	Calculated t- value	Critical t- value	Remark
P=0.05								
1	Experimental Group	20	7.5	2.36				
2	Control Group	20	6.6	2.25	19	1.68	1.71	Insignificant

Pre-test was conducted to test and ensure that there is no significant difference between the performance of students in the experimental and control groups prior to the treatment. This is necessary to verify that any change or difference in performance that may be observed in post-test is due to exposure to different method of teaching not other factors. The result of the analysis of the pre-test scores of both groups (experimental and control) shows that there is no significant difference between the two groups (at $p = 0.05$, $t_{\text{calc}} 1.68 \leq t_{\text{critical}} 1.71$). In other words, there is no difference in the performance of students in both groups before they were exposed to different

treatments (that is teaching oral English with and without audio-visual aids in the experimental and control groups respectively).

Research Question One: What is the mean achievement test score of students taught biology using of Activity-Based Instructional Strategy on the academic performance of students in Biology?

Table 2: Mean achievement test scores of students taught biology using of Activity-Based Instructional Strategy

S/N	Group	N	Total Score	Mean	Standard Deviation
1	Experimental Group	20	243	12.15	3.30

Table above shows the mean achievement test score of students in the experimental group who were taught biology using of Activity-Based Instructional Strategy. The table revealed that the achievement test score of the experimental group was 12.15 while the standard deviation (deviation of each score from the mean score) was 3.30.

Research Question Two: What is the mean achievement test score of students taught biology using conventional method (chalk and talk method)?

Table 3: Mean achievement test scores of students taught biology using conventional (chalk and talk method)

S/N	Group	N	Total Score	Mean	Standard Deviation
2	Control Group	20	169	8.45	3.31

Table above shows the mean achievement test score of students in the control group who were taught biology using conventional method (chalk and talk method). The table revealed that the achievement test score of the control group was 8.45 while the standard deviation (deviation of each score from the mean score) was 3.31.

Research Question Three:What is the difference in the mean achievement test score of students taught biology using Activity-Based Instructional Strategy and those taught using conventional method (chalk and talk method)?

Table 4: Mean difference for control and experimental groups in Post-test

S/N	Group	N	Mean	Standard Deviation	Mean Difference
1	Experimental Group	20	12.15	3.30	3.70
2	Control Group	20	8.45	3.31	

Data on table 4 shows that experimental group had a mean of 12.15 and Standard Deviation of 3.30 and control group had a mean score of 8.45 and a standard deviation of 3.31. This implies that students in the experimental group (taught biology using of Activity-Based Instructional

Strategy) had higher achievement test scores (with mean score of 12.15) than those in the control group (taught conventionally) (having a mean score of 8.45). The mean difference was 3.70

Testing of Hypothesis

The hypothesis was tested using the t-test correlation test for significance:

H₀₁: There is no significant difference between the performance of students taught biology using Activity-Based Instructional Strategy and those taught using conventional method (chalk and talk method).

Table 5: Calculated t- value for control and experimental groups in Post-test

S/ N	Group	N	Mean	Standar d Deviation	Degree of freedom	Calculate d t – value	Critical t- value P=0.05	Remark
1	Experimental Group	20	12.15	3.30	19	3.38	1.73	Significant
2	Control Group	20	8.45	3.31				

In Table 5, the result of the analysis of the Post-test scores of both groups (control and experimental) shows that there was significant difference between the two groups (at $p = 0.05$, $t_{\text{calc}} 3.38 \geq t_{\text{critical}} 1.73$). In other words, there was significant difference between the performance of students taught biology using Activity-Based Instructional Strategy and those taught using conventional method (chalk and talk method)..

Discussion of Findings

The study sought to determine the effect of activity based instructional strategy on the academic performance of students in Biology in Senior Secondary Schools in Pankshin Local Government Area of Plateau state. To achieve this, the researchers selected two schools and randomly selected 20 students from each school (10 students each in the experimental and control groups). The control group was taught Osmosis in biology using conventional method (chalk and talk method) while the experimental group was taught using Activity-Based Instructional Strategy. Prior to the treatment, both groups were given pre-test using the research instrument (i.e. Osmosis Achievement Test) to determine the intergroup correlation. After the treatment (i.e. teaching experimental and control groups with and without using Activity-Based Instructional Strategy respectively), posttest examination was administered and the script marked and scores recorded. The mean achievement test scores of the experimental and control groups were computed and independent t-test correlation was used to test the hypotheses (whether or not results were statistically significant). Findings from the study revealed that the use of using Activity-Based Instructional Strategy in teaching oral biology has significant effect on students' academic achievement. The result shows that before treatment (pre-test), there was no significant difference between the performances of students in the two groups. However, after treatment (i.e. teaching the experimental group using Activity-Based Instructional Strategy), the performance of the experimental group significantly outweighed that of the control group. The experimental group that were taught using Activity-Based Instructional Strategy had higher mean achievement scores (12.15) compared with their counterparts taught with conventional approach (with 8.45 mean achievement score as shown in Table 4). The difference in the mean achievement test scores of the two groups was 3.70. The reason for the higher post test achievement score by the experimental

group taught using Activity-Based Instructional Strategy was because students acquired real understanding and clear concept of osmosis in biology. When taught using Activity-Based Instructional Strategy, students gain mastery of what they have learnt. The findings agreed with Martins (2014) who observed that activity based instructional strategy provides significant gains in informal learning, retention and recall, rethinking and reasoning, activity, interest, imagination, personal growth and development of students. Martins further stresses that using Activity-Based Instructional Strategy materials help the teacher to overcome physical difficulties of presenting subject matter. With Activity-Based Instructional Strategy materials, the barrier of communication and distance is broken. The use of audio-visual aids also helps students remember pronunciations easily hence reduces mother tongue interference. The researcher also observed that using Activity-Based Instructional Strategy helps in increasing the interest of students in biology as students enjoyed the experimental session. The use of Activity-Based Instructional Strategy therefore should be encouraged and adopted in teaching science in secondary schools. McManus, Dunn and Denig (2013) stressed engaging learners actively in the learning process provides a means of individualizing instruction. This he said is possible through programmed learning which enables the learner to learn at his pace and also to work on his own.

Conclusion

The place of relevant instructional materials in the teaching and learning process cannot be overemphasized. To this effect, instructional aids that engage students actively in the teaching and learning process are indispensable in science teaching and learning. A close observation of the method employed by most science teachers in teaching biology in secondary schools in Pankshin local government reveals that the use of conventional chalk and talk method is common but not effective for teaching the subject. Furthermore, there is very poor availability and utilization of facilities and equipment needed in the teaching/learning science using activity-based approach. The submissions of the teachers working in these schools are that the equipment such as science laboratories are not available due to poor funding and where they are available, teachers are not adequately trained on the use of these facilities and other strategic means of teaching.

Having conducted the study successfully, from the results, analysis and discussion made so far, the researcher hereby draw the following conclusions:

- i. The use of activity based instructional strategy in teaching and learning biology in secondary schools leads to higher academic achievement among students and impacts positively on overall learning, retention and understanding.
- ii. The mean achievement scores of students taught biology using activity based instructional strategy was higher than their counterparts taught conventionally.
- iii. There is significant relationship between the use of activity based instructional strategy in teaching biology and students' performance in the subject area.

Recommendations

Based on the findings, the following recommendations were made:

- i. Curriculum developers such as Nigeria Educational Research and Development Council should incorporate the use of activity based instructional strategy into future curriculum design and implementation for science curriculum.

- ii. The government and private school owners as well as other stake holders in the education sector should invest in the provision of facilities and equipment needed for the use of activity based instructional strategy in teaching science, especially, biology.
- iii. School principals should organize internal workshops and seminars to train teachers on utilization and improvisation of means to use activity based instructional strategy in teaching biology.
- iv. In service training should be encouraged among biology teachers to update their pedagogical skills.

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