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Effects of Multiple Intelligence-Based Instructional Strategy On Secondary School Biologystudents Achievement And Interest In Delta State

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Abstract
The purpose of the study was to examine the effects of multiple intelligence-based instructional strategy on secondary school Biology students' achievement and interest in Delta State.Two research questions and two hypotheses directed the study. The study adopted quasi-experimental design. Population of the study was 29,031 SS II students. 226 SS II Biology students were used in the study. Biology Achievement Test (BAT) and Biology Interest Scale (BIS) were used for data collection. The reliability index of BAT was 0.77 and that of BIS was 0.73 which were established using Kuder-Richardson formula 21 and Cronbach-Alpha respectively. BAT and BIS were administered to students as pre-test before treatment and posttest after treatment. The generated data were analyzed using mean, standard deviation, and Analysis of Covariance (ANCOVA). The results revealed that: there was a significant difference in the mean achievement and interest scores among students taught Biology with multiple intelligence-based instructional strategy and lecture method, in favour of multiple intelligence-based instructional strategy. In order to promote and foster social interaction, active participation in learning, self-motivation, learning by doing, and learning by experience in the classroom, the study advised that Biology teachers use multiple intelligence-based instructional strategies.

Keywords: *Multiple intelligence-based, Achievement, Interest,Instructional Strategy.*

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I. Introduction

Biology is a natural science that investigates the physical structure, chemical processes, molecular interactions, physiological systems, development, and evolution of living organisms. Its name comes from the Greek words "bios" (life) and "logos" (study). Biology is the study of living things. Biology is a wide field that encompasses everything from the smallest substances in our cells to the larger concepts of ecosystems and global climate change. Movement, breathing, nourishment, irritability, growth, excretion, and reproduction are all covered by biology. Life processes are common to all living things, whether they are plants or animals, regardless of their geographical distribution. Biology explains bodily anatomy and physiology, health problems, microorganisms in our environment, their impacts, and how to control them.

The study of Biology cultivates in students specific qualities and characteristics such as curiosity, inventiveness, objectivity, the bravery to challenge, and aesthetic sensibility (Federal Republic of Nigeria, 2013). Biology teaching objectives in Nigerian schools are to help students develop problem-solving and decision-making skills, as well as to explore the connections between biology and health, agriculture, industry, and other elements of life. Economic progress, poverty eradication, and social welfare are all aided by biology education. Despite the importance of Biology, students keep performing poorly in Biology based on the evidence gathered from WAEC Chief Examiner's report on students' performance in the West African Senior Secondary Certificate Examination (WASSCE) from 2015 to 2018. The WAEC Chief examiner's Report (2013) showed that the 1,182,083 students who took Biology had a raw mean score of 21.0 and standard deviation of

10.34. In 2016, the 1,087,921 students that took Biology had a raw mean score of 31.0 and standard deviation of 11.79. In 2017 and 2018, the 1,087,921 and 1,087,884 students that sat for Biology had a mean score of 24.0 and 27.0, with a standard deviation of 9.22 and 10.34 respectively. This poor achievement in Biology has calls for the attention of the government and other stake holders in education.

The federal and state governments have made efforts to improve biology teaching and learning in schools by creating scientific laboratories and providing science equipment to schools (Nnaji, 2017). Students' achievement in Biology, however, continues to fall short of what is expected. Students' poor performance in Biology could be due to the lecture method of teaching used by most Biology teachers, which does not allow students to actively participate during instruction. The lecture method is a teaching method in which the teacher delivers material to pupils in its final form. With little or no opportunity to ask questions, the students listen and take notes. It is one of the oldest teaching methods. The lecture method has several drawbacks, including the fact that it does not inspire students to think critically and creatively, and that students are only passively involved in the teaching and learning process. Because students are only passively involved in the teaching and learning process, the lecture method encourages rote learning. With the employment of the lecture method, it is evident that the accomplishment of the cardinal objectives of teaching Biology at the senior secondary school level may be jeopardized. To improve students' achievement and interest in Biology, alternative teaching methods such as multiple intelligence-based instructional strategy that ensure active participation, practical skill acquisition, and caters for students' differing learning styles/intelligences may be used. The main goal of this research is to see if using multiple intelligence-based instructional strategy may boost students' Biology achievement and interest.

An instructional strategy that takes into account individual differences among learners is known as a multiple intelligence–based instructional strategy. It's a strategy in which a teacher uses several intelligences identified in Gardner's (1983) theory of multiple intelligences to accomplish the lesson's goals. In order to address students' intelligences, a multiple intelligence-based instructional strategy stresses a variety of instructional techniques. Gardner proposed the hypothesis of multiple intelligences in 1983, which divided intelligence into various specialized (mainly sensory) modalities. Gardner claimed that all individuals possess a number of diverse intelligences that exhibit themselves in a variety of talents and abilities and represent various methods of learning and demonstrating understanding. This new perspective on intelligence differs significantly from traditional perspectives, which often identify only two types of intelligence: verbal and linguistic.

Gardner (1983) asserted that the eight intelligences rarely work in isolation. In order to adequately cater for the diverse learning preferences of the students, teachers using the multiple intelligence approach in their classroom present their lesson using a wide variety of instructional techniques involving the use of words, numbers, and logic, music, group activities, physical activities, pictures, self reflection, and the physical environment. As a result, it is critical that teachers assess their students' learning in ways that allow them to harness their well-developed intelligence while also allowing them to succeed. Students could write reports, give oral presentations using visual aids they developed, experiment, present graphic designs, concept maps, models, independent projects, and creative assignments, among other things.

Multiple intelligence-based instructional strategy, according to Anaduaka (2008), stressed the following:

- the use of visual aids, visualization, color, art, metaphor, or visual organizers for students with strength in verbal-linguistic and/or logical-mathematical intelligences;
- the use of visual aids, visualization, color, art, metaphor, or visual organizers for students with strength in verbal-linguistic and/or logical-mathematical intelligences. This can include incorporating a discovery activity into a lesson that requires students to do particular mental processes such as observing, classifying, measuring, predicting, describing, and so on for both spatial and logical/mathematical intelligent children;
- using field trips and/or inviting professional guest speakers to connect learning concepts to real-life situations/experiences. For students with naturalistic and/or bodily-kinesthetic intelligences, c1assrooms are sometimes extended to the open field by taking students out of the classroom to learn about concepts in their natural setting;
- collaborative learning: Providing an enabling environment for learners to learn from one another for those students with interpersonal intelligence;
- Individual students working for the benefit of people with intrapersonal intelligence;
- those with musical intelligence can use music or environmental noises to set important points in a rhythm or tune;
- • The utilization of hands-on activities, games, and simulations that require complete engagement from learners.

Students' achievement and interest in numerous subject areas have been found to improve when they are taught using a multiple intelligences-based instructional strategy (Anaduaka, 2008; Nakhbi & Barza, 2016).

Statement of the Problem

An assessment of students' Biology performance in the West African Senior Secondary Certificate Examination (WASSCE) from 2015 to 2018 indicated a state-wide trend of poor performance. Biology students, according to the WAEC Chief Examiner's findings, lack knowledge of basic Biology experiments and lack the pre-requisite knowledge and skills to carry out Biology experiments.

Poor academic achievement in the Senior Secondary Certificate Examination (SSCE) and a lack of practical skills among Biology students can be linked to a variety of causes, including ineffective teaching methods. Due to the employment of the lecture method, students in Nigerian secondary schools have resorted to memorizing of Biology principles as a result of their lack of active participation in the teaching and learning process. In a lecture method classroom, students are not given the opportunity to manipulate discrete items through experimentation in order to draw inferences from their observations of these tangible objects. Students are not given the opportunity to learn facts independently. Furthermore, the lecture method does not take into account students' individual intellectual disparities. This necessitates the implementation of alternate teaching methods that allow students to seek information through experimental processes while also providing an inclusive educational paradigm that benefits students of various intellect levels. Alternative ways could include the use of multiple intelligence-based instructional strategy.

Hence, the problem of this study is: Will the use of multiple intelligence-based instructional strategy improve students' academic achievement and interest in Biology?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant difference in the mean achievement scores among students taught Biology with multiple intelligence-based instructional strategy and lecture method.
2. There is no significant difference in the mean interest scores among students taught Biology with multiple intelligence-based instructional strategy and lecture method.

The scope of this study was restricted to the effects of multiple intelligence-based instructional strategy and lecture method on secondary school students' achievement and interest in Biology in Delta State.

II. Methodology

The study adopted a quasi-experimental pretest, posttest control group design.The quasi–experimental design was used for this study because randomization of subjects is impossible since students in intact classes were used for this study to provide for stability and avoid disruption of class lessons.

The study tabular representation of the design is shown in Table 1.

Table 1: Tabular Representation of the Design

Group	Pre-test	Treatment	Post-test
Multiple intelligence-based strategy	O1	X_{MIBS}	O2
Lecture method (control)	O3	X_{Lec}	O4

Where,

O_1, O_3, are pretests of students in multiple intelligence-based and lecture groups respectively.

O_2, O_4, are posttests of students in multiple intelligence-based and lecture groups respectively.

X_{MBS}, and X_{LEC} are treatments using multiple intelligence-based and lecture methods respectively.

The population for the study comprised 29,031 SSII Biology students in the 443 public Senior Secondary Schools in Delta State (Ministry of Education, Exams and Standard, Asaba Delta State, 2020). Specifically, SSII students in all the public secondary schools in Delta State made up the population for this study.

The sample size for this study was 226 Biology students selected from 6 mixed senior secondary schools in Delta State. The schools were selected using stratified random sampling technique.

There were two research instruments for the study,namely;

i. Biology Achievement Test (BAT).

ii. Biology Interest Scale (BIS).

The Biology Achievement Test (BAT) contained 50 multiple choice objective test items. Each item contained four options (A-D) out of which one is the correct answer and the other three are distracters.. The 50 multiple choice items were constructed by the researcher from a six weeks lesson plan on: platyhelminthes; nematode; annelid; mollusca; arthropoda; pisces; amphibian; reptilian; aves and mammalian. In scoring the BAT, the researcher awarded a score of 2 marks to a student that ticked the right option and a score of 0 marks for wrong option for each item in the BAT.

The Biology Interest Scale (BIS) contained 20 items adapted from Nwafor and Oka (2018) . The responses to the Biology Interest Scale are framed on a 5 point-likert scale of Very Low Interest (VLI, 1), Low Interest (LI, 2), Undecided (U, 3), High Interest (HI, 4) and Very High Interest (VHI, 5). In scoring the BIS, the researcher rated the scores of students with high interest in Biology at 50 and above and low interest as 49 and below.

The validity of the Biology Achievement Test (BAT) and Biology Interest Scale (BIS) was carried out by three experts that comprised one experienced Biology Teacher in Government College in Ughelli North Local Government Area of Delta State, one lecturer in the Department of Science Education from Delta State University, Abraka and an expert in Measurement and Evaluation from Delta State University, Abraka. They determined the validity of the instruments by critically examining the clarity and appropriateness of the test item. Their corrections and suggestions were reflected in the final instruments produced.

The Reliability of the Biology Achievement Test (BAT) was established using the Kuder-Richardson 21 approach. The choice of this approach is because it is appropriate for multiple options objective 1test items. The BAT was administered to 45 SSII Biology students in Government College in Ughelli North Local Government Area of Delta State which is outside the selected schools for this study. Data obtained were subjected to Kuder-Richardson 21 formula. On analysis, a reliability coefficient value of 0.88 was obtained .

The reliability of the Biology Interest Scale (BIS) was established using Cronbach Alpha. This is because it is most appropriate for establishing the reliability coefficient of likert scale items. BIS was administered to 45 SSII Biology students in Government College in Ughelli North Local Government Area, who are outside the sample schools for this study. The response of the students were scored and subjected to Cronbach Alpha analysis using SPSS. On analysis, a reliability coefficient of 0.71 was obtained.

The treatment procedure commenced with the assignment of the selected schools into experimental (multiple intelligence-based strategy) and control (lecture method) groups. The 6 schools selected for the study were randomly assigned to the two groups namely- three multiple intelligence-based strategy groups and three lecture method groups.

Prior to the actual treatment, the researcher trained four Biology teachers out of the selected 6 Biology teachers (research assistants) on the implementation of multiple intelligence-based strategy. The training procedure that was used in this study was adopted from Ajaja (2013). The training lasted for 4 days using the instructional package (lesson plan) developed by the researcher.

Before the commencement of treatment, students in the two groups were pre-tested using the BAT and BIS to ascertain their level of achievement and interest in Biology. Scores obtained from the pre-tests were recorded for each group. During the actual treatment, the multiple intelligence-based group were taught using multiple intelligence-based instructional strategy. The lecture method was used to teach the students in the lecture group.

The following activities were carried out in each of the groups:

Multiple Intelligence-Based Strategy Classroom: In this group, the treatment procedure of Obianuju, Akuezuilo and Okoli (2015) will be adopted. The teacher incorporated the following multiple intelligence based instructional techniques: active learning, project based learning, collaborative learning, authentic instruction, experimentation and self assessment. These instructional techniques addressed the following multiple intelligences namely; visual- spatial, interpersonal and naturalistic intelligences. The students in the multiple intelligence group were taught using presentation, life specimens, models, maps, real objects, charts, simulations, charts among others. These visual aids that appeal to the sense of sight made the instruction authentic and addressed visual-spatial intelligence. The students were grouped in "fives", different sub-topics was assigned to them in order to enhance critical thinking and skills on a major topic (interpersonal and naturalistic intelligence). After which the students were allowed to present their findings and evaluate themselves through self assessment. Finally, the teacher evaluated the lesson and gave each group assignment on the proceeding lesson.

Lecture Method Classroom: In this group, the teacher provided the students with facts in the final form during the teaching and learning process. The students listened to the teacher as the teacher presents the lesson. The students were given little opportunity to ask questions as the lesson progresses. Thereafter, the teacher evaluated and summarized the lesson.

At the end of the 6 weeks treatment, post-test was administered to the students in the three groups using the BAT and BIS. The content of the post-test was similar to the pre-test but varied in item arrangement. Post-test scores were recorded against the two groups. Thereafter, the pre-test and post-test scores of students in the two groups collated and analyzed.

The research questions were answered using descriptive statistics ofmean and standard deviation. The hypotheses were tested using inferential statistics (Analysis of Covariance) at 0.05 level of significance.

Presentation and Analysis of Results

Hypothesis 1: There is no significant difference in the mean achievement scores among students taught Biology with multiple intelligence-based instructional strategy and lecture method.

Table 2: ANCOVA Comparison of Pre-test and Posttest Achievement Scores of Students Taught Biology Using Multiple Intelligence-Based Instructional Strategy (Experimental) and Lecture Method (Control)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	14994.587[a]	2	4998.196	36.116	.000
Intercept	52503.269	1	52503.269	379.378	.000
Pretest	10961.755	1	10961.755	79.207	.000
Strategy	4051.134	1	2025.567	14.636	.000
Error	30723.289	222	138.393		
Total	761640.000	226			
Corrected Total	45717.876	225			

Table 2 indicates that there is a significant difference in the mean achievement scores among students taught Biology using multiple-intelligence-based instructional strategy and lecture method, $F(2, 222) = 14.636$, $P(0.000) < 0.05$. Therefore, the null hypothesis is rejected. Therefore, there is a significant difference in the mean achievement scores among students taught using multiple imtelligence-based instructional strategy.

Hypothesis 2: There is no significant difference in the mean interest scores among students taught Biology with, multiple intelligence-based instructional strategy and lecture method.

Table 3: ANCOVA Comparison of Pre-test and Posttest Interest Scores of Students Taught Biology Using Multiple Intelligence-Based Instructional Strategy (Experimental) and Lecture (Control) Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6422.330[a]	2	2140.777	29.857	.000
Intercept	21072.311	1	21072.311	293.888	.000
Pretest	1767.791	1	1767.791	24.655	.000
Strategy	2063.921	2	1031.961	14.392	.000
Error	15917.830	222	71.702		
Total	825176.000	226			
Corrected Total	22340.159	225			

Table 3: Indicates that there is a significant difference in the mean interest scores among students taught Biology using multiple-intelligence-based instructional strategy and lecture method, $F(2, 222) = 14.392$, $P(0.000) < 0.05$. Therefore, the null hypothesis is rejected. Therefore, there is a significant difference in the mean achievement scores among students taught Biology with multiple intelligence-based instructional strategy and lecture method.

III. Discussion of findings

The finding of the study revealed that there is a significant difference in the mean achievement scores among students taught biology with multiple intelligence-based instructional strategy and lecture method, in favour of multiple intelligence-based instructional strategy. Multiple intelligence-based instructional strategy provides a robust learning platform that cater for students' of varied intelligences to enable them learning effectively. The use of multiple intelligence-based strategy ensured that students of different intelligences learn effectively since variety of instructional strategies are employed during instruction. This may have accounted for the higher mean achievement scores of students taught biology multiple intelligence-based instructional strategy compared to those taught using the lecture method. This finding concurs with the views of Al-Zoubi and Al-Adawi (2019) who reported there were statistically significant difference between the performance of students exposed to instructional activities based on multiple intelligences theory and those expose to the conventional teaching method.The findings are also in agreement with Yi-Cheng and Jeng-Fung (2018) who found that after implementing MI-based instruction, students in the experimental group outperformed those in the control group in terms of science learning motivation, science learning value, and active learning strategies, while students with low learning achievement improved their learning attitude, allowing them to develop a positive learning attitude toward biology classes and raising their class participation..

Effect of Multiple Intelligence-based Strategies and Lecture method on Students' Interest in Biology

The finding of the study revealed that there is a significant difference in the mean interest scores among students taught biology with multiple intelligence-based instructional strategy and lecture method, in favour of multiple intelligence-based instructional strategy. students taught using multiple intelligence- based instructional strategy outscore their counterparts taught using the lecture method. This implies that the use of multiple intelligence-based instructional strategies promotes students' interest in biology than the use of the lecture method. This finding agrees with that of Holstermann, Grube and Bogeholz (2010) who reported that hands-on activities improve students' interest in biology than the conventional lecture method. This finding also concurs with the views of Obianuju, Akuezuilo and Okoli (2015) who reported that multiple intelligence-based instructional technique promotes academic interest in difficult biology concept than the conventional lecture method.

IV. Conclusions

From the findings of the study, achievement and interest in biology depend on the instructional strategy. The students exposed to multiple intelligence-based instructional strategy were superior in achievement and interest than those expose to the lecture method. Therefore, multiple intelligence-based instructional strategy have proved to be a viable option in promoting meaningful learning in Biology.

V. Recommendations

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

1. Biology teachers should endeavour to teach students using laboratory- and multiple intelligence-based instructional strategies so as to improve students' achievement and interest in the classroom.
2. Biology curriculum planners should also endeavour to incorporate variety of instructional strategies to cater for students of various intelligences.
3. Regular workshops and seminars should be organized for biology teachers to abreast them of innovative instructional strategies and how to efficiently implement these strategies in actual classroom settings.

References

[1]. Ajaja, O. P. (2013). Which way do we go in the teaching of biology: Concept mapping, cooperative learning or learning cycle? *International Journal of Science and Technology Education Research, 4(2),* 18-29.

[2]. Ali, A., Soosan, L.,& Hamze, A. (2013). The effect of teaching strategy based on multiple intelligences on students' academic achievement in science course. *University Journal of Education Research, 1(4)*, 281- 284.

[3]. Al-Zoubi, S. M., & Al-Adawi, F. A. (2019). Effects of instructional activities based on multiple intelligences theory on academic achievement of Omani students with dyscalculia. *Journal for the Education of Gifted Young Scientists, 7(1),* 1-14. Available at http://jegys.org.

[4]. Anaduaka, U. S. (2008). Effect of Multiple intelligences teaching approach on students' achievement and interest in geometry. Unpublished PhD dissertation, University of Nigeria, Nsukka.

[5]. Federal Republic of Nigeria (2013). *National policy on education.* Abuja: NERDC.

[6]. Gardner, H. (1983). *Frames of mind*. New York: Basic Books.

[7]. Holstermann, N., Grube, D., & Bogeholz, S. (2010). Hands-on activities and their influence on students' interest. *Res Sci Educ, 40,* 743-757.

[8]. Ministry of Education, Delta State (2019-2020). *The population of students in Delta State*. Asaba, Delta State: PPEB, Exam and Standard.

[9]. Nnaji, J. I. (2017). Self-regulated learning with multimedia as correlates of secondary school students' achievement in physics. Unpublished M.ED Dissertation Submitted to the Department of Science Education, Faculty of Education, Nnamdi Azikiwe University, Awka.

[10]. Nwafor, C. E., & Oka, O. O. (2018). Secondary school students' interest inventory in biology. *International Journal of Humanities Social Sciences and Education (IJHSSE), 5(3),* 44-59.

[11]. Obianuju, O. S., Akuezuilo, E. O., & Okoli, J. N. (2015). Effect of multiple intelligence-based instructional technique (MIBIT) on stuents' interest in the learning of difficult biology concepts. *IOSR Journal of Research and Method in Education (IOSR-JRME), 5(3),* 01-09. Available at www.iosrjournals.org.

[12]. Ozdemir, P., Guneysu, S., & Tekkaya, C. (2006). Enhancing learning through multiple intelligences. *Journal of Biological Education, 40(2),* 74-78.

[13]. Yi-Cheng, C., & Jeng-Fung, H. (2018). The effect of multiple intelligences-based instruction on learning motivation and learning achievement in science courses. *US-China Education Review B, 8(8),* 329-337. doi: 10.17265/2161-6248/2018.08.001.

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