

EFFECT OF MULTIPLE INTELLIGENCE-BASED INSTRUCTIONAL APPROACH ON STUDENTS' INTEREST IN SECONDARY SCHOOL BIOLOGY

OBIMALUME NONYE VERONICA

Science Education Department

Chukwuemeka Odumegwu Ojukwu University

Uli, Anambra State, Nigeria

obimalumenonye@gmail.com

Abstract

This study investigated the effect of multiple intelligence-based instructional approach on students' interest in secondary school biology in Anambra State. Two research questions guided the study and two hypotheses were tested at .05 level of significance. The design adopted for this study was quasi-experimental design. Specifically, the pretest post test non-equivalent control group design. The population of the study comprises all 7,134 SS1 biology students made up of 3,214 males and 3,920 females in 2019/2020 academic session in three education zones in Anambra State. The sample for this study comprised 564 SSS1 biology students made up of 249 males and 315 females drawn using multistage sampling procedures. The instruments for data collection was titled "Biology Interest Scale" (BIS) which was duly validated using cronbach alpha which yielded 0.82. Mean and Standard deviation were used to answer the research questions and analysis of Covariance (ANCOVA) to test the hypothesis. The findings of the study revealed among others that students taught biology using multiple intelligence-based instructional approach had higher interest score than those taught using lecture method. The result further revealed that students taught Biology using multiple intelligence-based approach had higher interest scores than those taught using lecture method. Based on the findings, it was recommended among other that Science Teachers Association of Nigeria (STAN) should organize regular professional development programme for biology teachers on the use of multiple intelligence-based instructional approach in teaching the subject. The findings above were discussed and conclusions were reached. Limitations as well as suggestion for further studies were highlighted.

Keywords: Biology, multiple intelligence instructional approach, interest, Secondary Education, Anambra State.

Introduction

Biology is a science subject embodied with the scientific study of life. It is a scientific, logical, objective, quantitative and qualitative study of life. According to Joda (2019) biology is a life science subject concerned with the study of living organisms with regards to their structure, function, evolution, distribution, identification and taxonomy.

Biology is one of the science subjects taught in senior secondary schools in Nigeria. To this end, biology operates an instructional curricular structure to foster proactive understanding of man. According to Umar, Fugu and Aliyu (2018) biology which is the study of different

forms, their evolution structures, functions, growth, distribution and taxonomy occupies a unique position in the secondary school science curriculum. Onu, Anyaegbunam and Uzoigwe (2020) defined biology as a natural science which studies the existence (evolution, morphology and physiology) of living things as well as their interactions with non-living components of the earth. Owolabi, Babatunde and Gambari (2019) noted that the study of biology provides an ideal preparation and a prerequisite for pursuing a number of careers in science which include; Medicine, Pharmacology, Biochemistry, Pharmacy, Botany, Nursing, Agriculture, Microbiology, Zoology and other applied sciences.

Certain biology concepts are difficult for the teachers to teach and problematic for the learners to comprehend. Agboghroma and Oyorwi (2015) observed that growth and excretion system are among difficult and problematic concepts in Biology. Idodo-Umeh (2010) defined growth as the irreversible increase in volume (size) number of parts, length and weight of an organism while excretory system is the removal of waste or unnecessary materials from body of an organism. Djamabar, Ristanto, Sartono and Darmaawan (2020) defined excretion as the removal of metabolic waste substances in form of toxic compounds such as water, sweat, urine, bile and faeces. Okoli, Akuezulo and Okoli (2015) stressed that among the reasons advanced for this difficulty in mastery of these concepts is poor handling of the concepts by the teachers and ineffective methods of teaching these concepts.

The teaching of biology is dominated by lecture method which is teacher-centered instructional approach. According to Jada (2019) lecture method is a common method employed by teachers in teaching biology and in the course of using this method, teachers act as expository of all knowledge, while the students are passive recipients of knowledge transmitted by the teachers in the process of chalk, blackboard and textbook during instructional delivery. Similar to this, Mohammed (2019) observed that most of the teaching method are fact oriented, assigning a passive role to learners. Thus, the need to utilize students-centered teaching strategy becomes imperative, such as multiple intelligence-based instructional approaches.

Multiple intelligence based instructional approach (MIBIA) has been defined by different scholars in varying ways. For instance, Al-Zoubi and Al-Adawi (2019) noted that multiple intelligence based instructional approach (MIBIA) is a contemporary method of teaching which enables teachers take into account individual differences between the learners during teaching and learning process. Developed by Howard Gardner (1983) it differentiates intelligence into various specific modalities. Howard Gardner posited that individuals have multiple human abilities or smartness often referred to as intelligences based on a set of eight criteria. The eight intelligences are (i) **Verbal-linguistic intelligence**: Concerned with ability to think in words, using spoken and written words or languages to express ideas, appreciate meaning and accomplish some other goals. (ii) **Logical-mathematical intelligence**: This dimension is concerned with logical abstraction, inductive and deductive reasoning as well as use of numbers (iii) **Visual-spatial intelligence**: Is the ability to think and reason in pictures images, as well as some other mental works for an imaginative and expressing creation (iv) **Bodily-kinesthetic intelligence**: Concerned with the ability to use ones body part or the entire body to solve problems or fashion out products (v) **Musical intelligence**: This intelligence is the ability of an individual to be sensitive and more adapted to grasp knowledge through non-verbal sounds and to discern rhythmic, pitch, timbre and tone.(vi) **Interpersonal**

intelligence: This sort of intelligence enjoys and supported Lee Vygotsky's theory of social constructivism and is concerned with the ability of an individual to create knowledge through interactions with the human components of the environment (vii) **Intrapersonal:** This is concerned with innate understanding of one's self. Its interest is in ability of an individual to understand one's self, recognize ones feelings, strength and weaknesses towards knowledge creation (viii) **Naturalistic intelligence:** This aspect is more concerned with nature-nurturing and linking information to ones natural environment.

The students in biology classes differ in personality and intelligence. Thus, the teacher must be aware of these differences by using teaching methods that are appropriate to the students' dominant patterns of intelligence (AL-Zoubi& Al-Adawi, 2019). Anaduaka (2011) posited that multiply intelligences teaching approach enables lessons be presented through a variety of ways using pictures/drawings, music, cooperative learning, fieldtrips, activities, role, playing, games and much more so that each child has the opportunity to learn in ways harmonious with his/her God given talents. Teachers through keen observation of learners' activities should figure out the type of intelligence a learner is more gifted with and go on to determine ways of incorporating teaching strategies which can help the students' academic interest ameliorate.

Several scholars and authors have defined interest in different ways. According to Rowland, Knekta, Eddy and Corwin (2019) interest is associated with the terms "curiosity," "attitude," "liking," "attention," or "engagement". Nwafor and Oka (2018) stressed that arousing students' interests in learning biology can help them master biological knowledge and techniques better and also enhance the scientific spirits and attitudes. Interest promotes students participation in biology lesson and sustain their attention during classroom instruction. It is a cognitive and affective state of the learner especially with respect to their experiences within the environment that supports the teaching and learning of science. The researcher defined interest as feeling and attitude towards a particular thing or activity. Audu (2018) stressed that the individuals need arouses interest and motivates one to take action or to participate in activities that would lead to the satisfaction of that need. The students' interest is aroused when the effort to satisfy their learning need is felt. It basically stimulates directional feeling and engagement towards success. Fostering interest in teaching and learning of biology will enhance understanding of concepts being taught and extension help the biology students to maximize achievement. However, Ali, Toriman and Gasim (2014) observed that biology which is a fundamental science subject has been known to continuously record low students' interest and poor achievement levels in all examinations both internal and external. Nwafor and Oka (2018) reported that secondary school students have low interest in Biology concepts such as development and growth in animals, development and growth in plants, digestive system and digestion in humans, energy and energy types and excretion. Teachers could utilize appropriate teaching method to arouse the interest of students irrespective of the gender.

Gender as a moderating variable to this study has been an issue. Odo and Nwachukwu (2020) defined gender as a social or cultural construct, characteristics, behavior and roles which society ascribes to females and males. Nonetheless, the issue of gender and student's academic achievement especially in biology has been inconclusive. Some researchers are of the view that male students perform better than females, others disagree with this view. Contrary to

the above findings, the result of the study conducted by Amedu (2015), revealed that there was a significant difference between the mean scores in the favour of the males. The need arises for further studies take gender into consideration in an attempt to build a new evidence of the effect of multiple intelligence-based instructional approach on students achievement in secondary school biology in Anambra State.

Statement of the Problem

The students' poor academic achievement in SSCE Biology has attracted a lot of concern from science educators and other education stakeholders in Anambra State. Thus, research in Science Education and State Government has continued to seek better ways of teaching Biology through training of teachers on different teaching methods. Despite the fact that the training had result in remarkable improvement on students' academic achievement in biology examination in secondary schools in Anambra State, there is still room for excellent outstanding students' academic achievement of students in Biology through the use of multiple intelligences teaching approach. It has thus become necessary for the present study to investigate the effect of multiple intelligence-based instructional approach on students' achievement in secondary school Biology in Anambra State.

Purpose of the Study

The main purpose of the study is to investigate the effect of multiple intelligence-based instructional approach on students' achievement and interest in secondary school biology in Anambra State. Specifically, the study seeks to examine the:

1. Mean achievement scores of students taught biology using multiple intelligence-based instructional approach and those taught using lecture method.
2. Mean achievement scores of male and female students taught biology using multiple intelligence-based instructional approach.

Research Questions

The following research questions will guide the study:

1. What is the mean achievement scores of student taught biology using multiple intelligence-based instructional approach and those taught using lecture method?
2. What is mean achievement scores of male and female student taught biology using multiple intelligence-based instructional approach.

Hypotheses

The following hypotheses will be tested at .05 level of significance.

1. There is no significant difference in the mean achievement scores of students taught biology using multiple intelligence-based instructional approach and these taught using lecture method.
2. There is no significant difference in the mean achievement scores of male and female students taught biology using multiple intelligence-based instructional approach.

Method

This study adapted a quasi-experimental research design, aimed at determining effect of multiple intelligence-based instructional approach on students' achievement in secondary school biology. The population consists of 7,134 SS II biology students made up 3,214 males and 3,920 females in 2019/2020 academic session in three education zone in Anambra State.

Simple random sampling techniques involving balloting without replacement was used to pick three schools from the education zone.

The instrument used for data collection was Biology Achievement Test (BAT) which was duly validated by three experts.

Mean and standard deviation were used to answer the research questions and Analysis of Covariance (AVCOVA) to test the hypotheses.

Results

The results of the study were presented according to the research questions and the hypotheses in tables 1, 2, 3 and 4.

Research Question 1: What are the mean achievement scores of student taught biology using multiple intelligence-based instrumental approach and these taught using lecture method?

Table 1: Mean Pre-test and Post-test Mean Achievement Scores of Students taught Biology using Multiple Intelligence Based Instructional Approach (MIBIA) and those taught using Lecture Method (LM).

M e t h o d	N	Pretest Mean	Posttest Mean	Mean Gain	Pretest SD	Posttest SD
M I B I A	2 5 3	3 0 . 1 7	8 3 . 9 9	5 3 . 8 2	5 . 2 1	3 . 8 1
L M	3 1 1	2 0 . 3 3	5 0 . 0 3	2 9 . 7 0	6 . 1 1	4 . 5 5

Table 1 showed that students taught biology with multiple intelligence-based instructional approach had pre-test achievement mean score of 30.17 with standard deviation of 5.21, their post test mean achievement score was 83.99 with 3.81 value of standard deviation and mean gain of mean gain. Those students that were taught biology with lecture method had pre-test achievement mean score of 20.33 with standard deviation of 6.11, their post test mean achievement score was 50.03 was 4.55 value of standard deviation and 29.70 mean gain. The result indicated that students taught biology using multiple intelligence-based instructional approach had higher achievement score than those taught using lecture method.

Research question 2: What is mean achievement scores of male and female students taught biology using multiple intelligence-based instructional approach?

Table 2: Mean pre-test and posttest mean achievement scores of Male and Female students taught Biology using Multiple Intelligence-based Instructional Approach (MIIA)

M e t h o d	N	Pretest Mean	Posttest Mean	Mean Gain	Pretest SD	Posttest SD
M A L E	1 1 2	2 9 . 1 0	7 8 . 4 2	4 9 . 3 2	4 . 1 1	2 . 1 5
F E M A L E	1 4 1	3 2 . 1 9	8 5 . 1 3	5 2 . 9 4	5 . 0 4	3 . 1 0

From the result on Table 2, it was observed that male students taught biology with multiple intelligence-based instructional approach had pre-test and post-test mean achievement scores of 29.10 and 78.42 respectively resulting in a mean gain of 49.32, and also pre-test and post-test standard deviation sore of 4.11 and 3.25 respectively, while female students taught biology with multiple intelligence-based instructional approach had pre-test and post-test

mean achievement scores of 32.19 and 85.13 respectively resulting in a mean gain of 52.94, and also pretest and posttest standard deviation scores of 5.04 and 3.10. The result revealed that multiple intelligence-based instructional approach had a greater effect in the academic achievement of female students in biology than male students.

Hypothesis 1: There is significant difference in the achievement scores of students taught biology using multiple intelligence-based instructional approach and those taught using lecture method.

Table 3: ANCOVA on Difference between the Mean Achievement Scores of Students taught Biology using MIIA and those taught LM.

Biology using MINITAB and those taught EMV.								
Scores of Variation	S	S	D f	M	S	F	P- v a l u e	Decision
Corrected Model	20709.884 ^a	2		10354.942		481.177	. 0 0 0	
I n t e r c e p t	75003.951	1		75003.951		3504.504	. 0 0 0	
P r e t e s t	. 5 0 1	1		. 5 0 1		. 0 1 4	. 9 0 6	
M e t h o d	20266.513	1		20266.513		939.121	. 0 0 0	S
E r r o r	2030.802	8 9		2 2 . 8 1 8				
T o t a l	414619.000	9 2						
Corrected Total	22733.250	9 1						

Table 3 shows that at .05 level of significance, idf numerator and 91 df denominator, the calculated F is 939.121 with P-value of .000 which is less than .05. Thus, the null hypothesis was rejected. Therefore, there is a significant difference in the achievement scores of students taught biology using multiply intelligence-based instructional approach and those taught using lecture method in favour of the experimental group.

Hypothesis 2: There is no significant difference in the mean achievement scores of male and female students taught biology using multiple intelligence-based instructional approach.

Table 4: ANCOVA on Difference between the mean Achievement Scores of male and female students taught Biology using multiple Intelligence-based Instructional Approach.

Scores of Variation	S	S	D f	M	S	F	P-value	Decision
Corrected Model	112.168 ⁿ	2		5 6 . 0 8 4		1.069	3 5 3	
I n t e r c e p t	22398.561	1		22398.561		1082.138	0 0 0	
P r e t e s t	1 2 . 9 9 1	1		1 2 . 9 9 1		5 8 1	4 5 0	
G e n d e r	2 8 . 3 8 8	1		2 8 . 3 8 8		1.375	2 4 8	N S
E r r o r	846.742	4 1		2 0 . 6 5 2				
T o t a l	108900.000	4 4						
Corrected Total	890.909	4 3						

Table 7 shows that at .05 level of significances, idf numerator and 43df denominator, the calculated f is 1.375 with P-value of .248 which is greater than .05. Thus, the null hypothesis was not rejected. Therefore there is no significant different in the mean achievement scores of male and female students' taught biology using multiple intelligence-based instructional approach.

Discussion of Findings

The findings are discussed under the following subheadings

1. Mean Achievement Scores of students taught Biology using Multiple Intelligence-based Instructional Approach and Lecture Method.
2. Mean Achievement Scores of Male and Female Students taught biology using multiple intelligence-based instructional approach.

Mean Achievement Scores of students taught Biology using Multiple Intelligence-based Instructional Approach and Lecture Method

The findings of the study revealed that students taught biology using multiple intelligence-based instructional approach had higher mean achievement score than those taught using lecture method. This is in consonance with the earlier report of Nakhbi and Barza (2017) which indicated the students taught using multiple intelligence-based instructional strategies had greater science achievement scores and better attitudes towards learning science than students taught with traditional methods.

Analysis of analysis indicated that there is a significant difference in the mean achievement scores of students' taught biology using multiple intelligence based instructional approach and those taught using lecture method in favour of the experimental group. This agreed with the finding of Al-Zoubi and Al-Adawi (2019) who reported that there was statistically significant difference between the mean achievement score of student taught using MIBIA and those taught using lecture method in favour of student in experimental group.

Mean Achievement Scores of Male and Female Students taught biology using multiple intelligence-based instructional approach

It was found out that multiple intelligence-based instructional approach had a greater effect in the academic achievement of female students in biology than male students. This is in disagreement with the findings of Jack and Japhet (2020) who reported that male students taught using MIBIA gained in mean achievement score more than their female counterparts.

The result of the study further revealed that there is no significant difference in the mean achievement scores of male and female students taught biology using multiple intelligence-based instructional approach. This is in support of the finding of Jack and Japhet (2020) which revealed that there is no significant difference in attitudes scores of male and female students taught using MIBIA. However, this contradicted the finding of Fatokun and Samuel (2019) who reported that there was a significant difference in the mean achievement scores of male and female science students exposed to multiple intelligence instructional strategy.

Conclusion

Based on the results obtained from this study, it is concluded that the multiple intelligence-based instructional approach has proved to be effective method of teaching biology. Multiple intelligence-based instructional approach was found to be superior to lecture method in teaching biology to senior secondary school students. Students develop and learn differently and multiple intelligence-based instruction approach reflect and suit students' individual abilities and learning styles. Students irrespective of their gender have benefited from learning of biology using multiple intelligence-based instructional approach. The benefits derived by

students as a result of learning biology using MIBIA has in turn lead to a considerable improvement in their academic achievement.

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