Research Article

Effects of Social, Cognitive and Instructional Closure Teaching Methods on Students' Achievements in Biology in Secondary Schools.

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ABSTRACT: *The Persistent poor performance of students' achievement in biology had given concern to all facets of the society. Also the teaching methods used by teachers in teaching Biology in Nigerian secondary schools had been implicated. In view of the above problems, the study was designed to investigate the effects of social, cognitive and instructional closure teaching methods on SS2 students' achievement in Biology. The researcher adopted a non-equivalent quasi-experimental design. A sample of 378 SS2 students was drawn from the three schools in Enugu education zone of Enugu State. In each of the three school used, one intact class was randomly drawn, one intact class was then randomly assigned to the experimental groups 1, II and the other intact class was assigned to conventional group 111. The three groups were taught using social, cognitive and instructional/conventional closure methods for experimental group I (social), experimental group II (cognitive) and conventional group 111 (taught with instructional) closure methods. A research question and a hypothesis guided the study. Relevant data for the study were collected using Biology Achievement Test (BAT). Research question was answered using mean and standard deviation while hypothesis was tested using Analysis of Covariance (ANCOVA). The results revealed that the use of cognitive closure teaching method in teaching Biology in the secondary schools was found to achieve higher than those taught using social and instructional closure teaching methods/conventional whereas the use of social closure teaching method was found to be better than the use of conventional/instructional closure teaching method. Some recommendations were made based on the findings of the study*

Keywords: Biology, Cognitive, Conventional, Closure methods, Students' achievement

I. INTRODUCTION

Biology is the study of living and non-living things. It deals with facts and words associated with reasoning which is essential for technological growth. Biology is seen as a tool in realizing the nation's objective and technological aspirations. Biology is a subject that encroached into all aspects of human endeavors and further described it as the life wire in the studies of various sciences. It is man's most basic tool without which it would be difficult for man and woman to live together, to think, to act, and share ideas together. Biology makes it possible for man to engage in scientific conversation of transfer of ideas, thoughts and feelings through science, and to develop scientific inquires [1]. The usefulness of Biology in every facet of human life is so glaring that there is no school curriculum or a national development planning without emphasis on the use of Biology. In Nigeria for instance, the broad aims of secondary education in her national policy on education [2] are as follows:
1.   Preparation for useful living
2.   Preparation for higher education. To achieve the above goals the policy includes Biology (science) as a core and compulsory subject.

[3] observed that there exists a wave of indifference, which borders on almost total dislike for Biology (science) among secondary school students. He noted that it is generally assumed erroneously though that biology is too voluminous.,[2] .On the bases of the national policy on Education and with particular reference to aims and objectives of secondary education, the Federal Ministry of Education, listed the Biology as enabling the individual to:

(a)   think creatively and consecutively in scientific terms.
(b)   acquire manipulative skills in science (Biology).
(c)   apply Biology skills.
(d)   comprehend the wide applicability of Biology in other disciplines.
(e)   discover, appreciate and admire the beauty and elegance of nature.

These objectives of the Federal Government can be realized using (social, cognitive and instructional) closure methods in teaching Biology in secondary schools. [4] defined closure methods as directing attention to the completion of specific tasks or learning sequence. The term closure describes what the teacher does, the strategies he adopts or hopes to t adapt to wrap-up the day's lesson. It could be relating the day's lesson to what the next lesson is going to be, giving assignment that will be done at home, allowing students to ask questions on what they failed to understand and seizing any unpleasant opportunity that may suddenly offer itself to end the lesson. Closure as a teaching method concerns the teacher's efforts to help students perceive the logical organization of the lesson at critical period intervals during the presentation of the subject/course contents and learning activities. What has a beginning should have an end. What begin well should also end well. While set induction sets the stage for the lesson stimulus variation, use of examples, planned repetition, non verbal communication all come up during the movement of the lesson. Questioning skills can be used all through the lesson and at intervals from the beginning to the end of the lesson. But closure rounds off the lesson [5]. Three types of closure methods are institutional, cognitive and social closure methods. When the teacher shows the link between past knowledge and new knowledge at the end of his lesson, instructional closure is reached. He may give summary of the key points covered in the lesson objective which students need to remember as the lesson progresses, salient points are scattered and it is the collection, organization and presentation of these points in a logical order by the teacher at the end of the lesson that is termed instructional closure. The bringing together of these points enables students to differentiate between relevant and less relevant, central and peripheral points which could be the new skills which should be mastered by the learners. These key points of the lesson should be linked up with the students' earlier learning. In institutional closure, the teacher alone does the summary while in cognitive closure the students are actively involved. The students summarize by themselves and perceive the logical organization of the lesson. The teacher asks questions for students to react and demonstrating good understanding of the sequential arrangement of the key ideas or skills clearly. It is directed at consolidating what the students have learnt and not only what the students' attention on major aspects covered in the lesson. Cognitive closure may take form of questions and answer dramatization or demonstration.

Lesson cloud also be concluded by using social closure method .Social closure is aimed at giving the learners a feeling of achievement and encouraging them to continue trying. It is rewarding, practicing and encouraging type of closure. It could be achieved by friendly looks or gesture in applying this closure, some teachers sings song that is familiar and related to the lesson. Whichever type of closure method is used, lesson should have closure.

The advantage of closure method is that, it is an important part of a lesson. It is used to recapitulate the salient points of a lesson. It also reinforces the learners during the lesson.

Achievement in Biology has worried scholars in the field of Biology. A study carried out on achievement in Biology (science) by [6] showed that achievement in Biology consistently becomes poor at secondary school level. [7] report on students' performance revealed a progressive decline in Biology achievement. For instance, in the year 1998, 32.81% passed with credit level and above, in 1999 and 2000, they achieved 18.25% and 11.15% respectively. There is an urgent need to arrest this ugly trend.

The achievement of students in Biology is closely related to the use of instructional methods. For instance, [8] pointed out that no real education may take place without appropriate instructional methods. Consequently, the present work will

investigate the level of students' achievement when instructional, cognitive and social closure methods are used in the teaching of Biology in Secondary Schools in Enugu Education Zone of Enugu State.

Several observations have been made by scientists and Biology teachers on the neglect of the use of vital instructional methods such as instructional, cognitive and social closure methods in our primary and secondary schools in Nigeria. This ugly trend has led to the students' poor performance in Biology in senior secondary school certificate examinations in Nigeria. Furthermore, this unfortunate situation of not using instructional, cognitive and social closure methods has been contributed to the students dwindling performance in Biology. Consider for instance, in 1995 out of 10, 120 candidates who sat for senior secondary school certificate examinations in Biology in the Zone only 10% passed at credit level [3].
 It appeared that in Nigeria, teachers are more conversant in teaching without instructional closure method, which is conventional/ traditional method of teaching, than they are with the use of cognitive and social closure methods. A question that arises then is: is the use of the instructional closure method/conventional, better than the use of cognitive and social closure methods in achieving higher performance in Biology in secondary schools? It appears that there is no empirical study so far that studied the relative effectiveness of the instructional, cognitive and social closure methods in teaching Biology in senior secondary schools in Enugu Education Zone of Enugu State. Moreover, it is not certain which instructional method is associated with student's higher achievement in senior secondary school Biology.
The purpose of the study is to find out the effects of the cognitive, social instructional/conventional closure teaching methods on students' achievement in Biology. This study was delimited to ascertain the effects of cognitive, social and instructional/conventional closure methods on secondary school two (SS2) students' achievement in Biology in Enugu Education Zone of Enugu State. It will find out the level of difference in the mean achievement scores of students taught using cognitive, social and instructional/conventional closure methods in Biology.

1.1 Significance of the study

The findings of this study will be useful to students, teachers, authors and publishers. The findings of this study if applied will also be useful to curriculum planners, and researchers.
It will be useful to students because it enhances students' achievement in Biology due to its novelty, which in turn may lead to higher achievement in Biology. The findings of this study will be useful to Biology teachers especially those in senior secondary schools. It will provide them with additional instructional techniques/methods for teaching certain Biology topics for better assimilation which in turn will enhance student's achievement. It will be useful to authors and publishers because it will serve as additional instructional methods of presenting their Biology skills in Nigerian school Biology text books. This finding will be beneficial to curriculum planners in drawing up and restructuring Biology curriculum of senior secondary schools by making Biology teaching at this level more resourceful and practical oriented. Lastly, the result of this study could be beneficial to researchers as a point of reference for further studies in other related disciplines.

1.2 Research question

The research question that guided the study is as stated below:

What is the difference in the mean achievement scores of students taught Biology using cognitive, social and instructional/conventional closure teaching methods on senior secondary school students' achievement?

1.3 Hypothesis

The following null hypothesis (Ho) was tested at 0.05 levels of significance.

There is no significant difference in the mean achievement scores of students taught Biology using cognitive, social and instructional/conventional closure teaching methods on senior secondary school students' achievement

II.   RESEARCH METHODS

The design for this stduy is quasi-experimental. The design is specifically a pretest –post-test, non equivalent group design. The choice of this design agrees with [9] who observed that this design is often used in classroom experiments when experimental and non-control groups are naturally assembled groups, such as intact classes will be randomly assigned to experimental group I, II and conventional III respectively.

Table 1:Diagrammatic Representation of Pre test – Post test Control Group Design

Group	Pre Test	Research Conditions	Post Test
E_1	O_A	X_1	O_B
E_2	O_A	X_2	O_B
C_3	O_A	X_3	O_B

Where
E_1 = Represents experimental treatment group on cognitive closure teaching method
E_2 = Represents experimental treatment group on social closure teaching   method
C_3 = Represents experimental treatment group on conventioanl/
  instructional closure teaching method.
O_A = Represents pre test on achievements
O_B = Represents post test on achievements
X_1 = Represents treatment condition on cognitive closure teaching method
X_2 = Represents treatment condition on social closure teaching method
X_3 = Represents treatment condition on coventional/instructional closure teaching mehtod.

The area covered by this study is Enugu Education Zone of Enugu State. It is made up of Enugu East, North and Isi-uzo Local Government Areas.

The population for this study comprises all the 1648 senior secondary school SS2 Biology students in all the three Local Government Areas in the 23 secondary schools in Enugu Education Zone

Stratified simple random sampling was used to draw three schools from each Local Government Area. In each of the sampled schools, purposive, simple random sampling was used to pick three intact classes of SS2 in each school. Three intact classes were randomly assigned to the experimental group I, II while the other was assigned to conventional group III. In all, a total of 378 students were used in experimental groups while 126 students was in the conventional group, giving a grand total of 378 students that was used as research subjects in the study.

Biology Achievement Test (BAT) developed by the researcher was used for data collection. The number of periods that essentially cover a particular unit and the objectives of the Biology contents guided the development of BAT. This implies

that where more time was required to teach a unit, more items were drawn from such a unit. BAT consisted of 30 objective test items.

The choice of objective test items is to allow the researcher to cover more topic areas. Twenty objective test items were at the lower cognitive level (that is knowledge and comprehension) while 10 items were in higher thinking process (that is application). The instrument was used for pre test and post test but the serial numbers of the items were rearranged during post testing. The items for the BAT were written to reflect the specification in a test blue print prepared.

The instrument went through both face and content validations.
Face Validity: The items of BAT and experimental packages were subjected to face validity by two experts in Biology and one expert in measurement and evaluation. The instrument and experimental packages were reviewed in terms of clarity and appropriateness of the language used. Their critical appraisal and comments were useful in modifying the items of the tests and experimental packages. The surviving items therefore possessed adequate face validity of the instruments for data collection.

Content Validity: Content validity is a measure of the extent to which the instrument is a representative of content and behavior specified by the theoretical concept being measured. The table of specification was validated by the experts to determine how effective it is in selecting questions considering the percentage allocation of the various levels of content. Thirty questions survived out of 47 questions after validation and reflected the table of specification. The number of questions in the category of knowledge and comprehension is 60% while the number of questions in the category of application is 40%.

The reliability of BAT was determined using test re-test method. The choice is because it is most suitable and appropriate in determining the correlation between sets of scores from two administrations of the test. The BAT was trial tested in Model Community Secondary School Olo in Ezeagu L.G.A of Enugu State. The BAT was re-administered to the students and data collected. Then the two sets of scores from first and second administration of BAT were correlated using the Pearson-product moment correlation. A correlation co-efficient value of 0.86 was obtained.

2.1 Experimental Procedure

Three Biology teachers from each of the sampled schools receive training for a period of one week from the researcher on the use of cognitive, social and instructional/conventional closure teaching methods conventional in teaching Biology respectively. Prior to the treatment, the Biology teachers in the sampled schools who received training on how to use the research instruments, administered the BAT respectively to their SS 2 students. At the end of the test, the question papers and the answer scripts were collected from each student who took the pre test. This is because the same test item is used for post test, except that the serial numbers of the items will be rearranged in the post test. This made the items look different at first glance. After the pre-test, the teachers provided treatment to the students for a period of three weeks. At the end of the duration of the treatment, the teachers re-administered the BAT respectively as post tests. The treatment in the experimental group consisted of cognitive, social and instructional/conventional closure teaching methods.

2.2 Experimental Control

There are some extraneous or confounding variables that the researcher feel can constitute potential threats to the validity, reliability and generalization of the results of this study. Such variables include inter-group variables, teacher variables and

Hawthorne effect. In seeking to achieve validity, the following effect or measures were made to ensure that these confounding or intervening variables, which might introduce bias into the study, were either minimized or controlled.
Inter Group Variable: To remove the errors of non-equivalence arising from non randomization of the research subjects, analysis of covariance (ANCOVA) was used in data analysis. This is to correct the error of initial difference in the ability levels among the research subjects.

Teacher variable: To minimize the error which may arise due to teacher difference, the researcher gave lesson notes prepared by the researcher on the topics to all the Biology teachers who were used for the study. The lesson notes and procedures for the presentation were fully discussed with the teachers, each teacher taught on equivalent number of students during trial teaching using the lesson notes. After the trial teaching, discussion was held on the teachers' presentation of the lessons.

Hawthorne Effects: This is a situation in which the research subjects' behavior is affected not by treatment per se but by their knowledge of participation in the study. This was avoided by the use of regular Biology teachers in the school in administering the treatments. The researcher was not directly involved in the treatment in order to avoid sensitizing the students being used for the research.

2.3 Method of Data Collections

BAT was administered respectively as pre-tests on the first week of treatment by research assistants. Scores of the students on the pretests were recorded and kept for use after the experiment. The posttest data were also generated after re-administration of BAT to the students on the last week of treatment. For each of the groups, data for pretests and post tests were recorded separately. The test item on BAT was scored two marks each to give a maximum mark of sixty.

2.4 Method of Data Analysis

Mean and standard deviation were used in analyzing the research questions. Mean was used because it is the most appropriate statistical tool to use for such situation and as such takes all measurement (observations) into consideration. Analysis of covariance was used to test the hypothesis. Analysis of covariance (ANCOVA) is used because intact classes were used and as such corrects the error of initial differences in the ability levels among the students involved in the study.

2.5 Decision Rule

Reject the null hypothesis (H_o) at 5% level of significance if $t_{calculated}$ is greater than $t_{tabulated}$ then otherwise accept.

III.   RESULT

In answering the research: what are the differences in the mean achievement scores of students taught Biology using cognitive, social and instructional/conventional closure teaching methods on senior secondary school students' achievement? The results are as shown on TABLE 2 below

Table 2: Mean Achievement Scores and Standard Deviations of Students taught Biology Using Cognitive, Social and Instructional/Conventional Closure Teaching Methods.

	Mean (X)		Standard Deviation		N
Groups	Pretest	Posttest	Pretest	Posttest	
Experimental Group I (Cognitive)	20.08	73.07	1.06	4.38	126
Experimental Group 2 (social)	22.34	54.71	2.60	6.83	126
Experimental Group3 (Instructional/Conventional)	24.41	26.17	2.81	8.26	126
Total					378

TABLE 2 above indicated that the experimental group 1 taught Biology using cognitive closure teaching method obtains 20.08 in pretest and 73.07 in posttest. The group also had standard deviation of 1.06 and 4.38 in pretest and posttest respectively. The table showed that the experimental group 2 taught Biology using social closure teaching method obtains mean achievement scores of 22.34 and 54.71 in pretest and posttest respectively. The group 2 equally had standard deviation of 2.60 and 6.83 in pretest and posttest respectively. Alternatively, the conventional method Group 3 taught Biology without using instructional closure teaching method got mean achievement scores of 24.41 and 26.17 in the pretest and posttest respectively. The group also had standard deviation of 2.81 and 10.26 in pretest and posttest respectively.

The result above revealed that the experimental Group I taught Biology using cognitive closure teaching methods achieved higher than those taught Biology using social closure teaching methods. Contrary the conventional Group 3 that is, those taught Biology using instructional closure teaching methods had the least performance. This finding was in line with those of similar experimental studies in science and science related subjects [10] and [11] where the experimental treatment groups proved better than the conventional group.

Table 3: Analysis of Covariance for Students Overall Mean Achievement by using the Cognitive, Social and Instructional/Conventional Closure Teaching Methods in Teaching Biology

Source of variation	Sum of square	Df	Mean square	F-Cal	Significance	Decision
Covariance variation	7163.867	1	8163.867	117.629	000	
Main effect	18830.993	3	3415.496	242.867	000	
Instructional methods	2798.077	2	2598.077	44.536	000	
Error	15102.931	287	68.561			
Residual	12126.312	4	2431.578	36.034		
Total	51922.18	303	21875.579			

S = Significance at $P<.05$

From the result of Analysis of covariance in TABLE 3 above, it was observed that <F (44.536) = 0.000; P< 0.05>. This means that the F calculated, F (44.536) is greater than the F critical. Thus, the null hypothesis of no significant difference in the mean achievement scores of SS2 students taught using cognitive, social and instructional/conventional closure teaching methods in teaching Biology was rejected at 5% levels of significance. This implies that the use of (cognitive, social and instructional/conventional) closure teaching methods in teaching Biology influence significantly students' achievement in Biology.

IV. CONCLUSIONS

The researcher therefore concluded that there was a significant difference in the mean achievement scores of students taught with cognitive, social closure teaching methods and those taught with conventional in favour of cognitive, followed by social closure teaching method. Contrary the use of instructional/conventional closure teaching method had no significant effects on the students' achievement in Biology in the Senior Secondary Schools.

V. RECOMMENDATIONS

Based on the results of this study, the following recommendations were made
1.   The serving teachers of Biology in secondary schools should adopt the use of cognitive and social closure teaching methods in teaching Biology lessons.
2.   In view of the fact that most of the serving teachers may not be familiar with the use of cognitive, social and instructional/conventional closure teaching methods courses in teacher education, in-service programmes should be made to emphasize the need to teach the subject using cognitive, social and instructional closure teaching methods among other things.

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