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EFFECTS OF FORMAL AND INFORMAL COOPERATIVE LEARNING METHODS ON STUDENTS' ACHIEVEMENTS IN BIOLOGY IN SECONDARY SCHOOLS

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Abstract

The problems, the study was designed to investigate the effects of formal and informal cooperative learning methods on senior secondary school two (55 2) students' achievement in Biology. The researcher adopted a non-equivalent quasi-experimental design. A sample of 270 552 students was drawn from three schools in Enugu East Local Government Area, of Enugu State. In each school used, two intact classes were randomly drawn; one intact class was then randomly assigned to the experimental and control groups respectively. The two groups were taught using formal and informal cooperative learning methods respectively. 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 Co variance (ANCOVA). The results revealed that the use of informal cooperative learning method was found to achieve higher than formal cooperative learning method. Based on the findings of the study, the researcher recommended that the serving teachers of Biology in secondary schools should adopt the use of informal cooperative learning method in teaching Biology lessons than formal cooperative learning method.

Introduction

Biology is the study of living and non-living things. Biology deals with facts and words associated with reasoning which is essential for technological growth. Biology is a subject that encroached into all aspects of human endeavors and it is described as the life wire in the studies of various science subjects (Maduabum (1984). 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, transfer of ideas, thoughts, feelings and to develop scientific inquires. The usefulness of Biology in every human life is so glaring that there is no school curriculum or a national development planning without emphasis on the knowledge of Biology. In Nigeria for instance, the broad aims of secondary education in her national policy on education (Federal Government of Nigeria, 2013) are as follows:

1. Preparation for useful living
2. Preparation for higher education.

To achieve the above goals, Biology (science) is a core and compulsory subject. There exists a wave of indifference, which borders on almost total dislike for Biology (science) among secondary school students. It is generally assumed erroneously that biology is too voluminous.

Maduabum (1984) listed the aims and objective of Biology as enabling the individual to:

- (a) think creatively 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.

Those aims and objectives of the Biology can be realized using formal and informal cooperative learning methods in teaching Biology in secondary schools. Panitz (1996) defined cooperative learning method as a structure of interaction designed to facilitate the accomplishment of a specific end product or goal through people working together in groups. According to Johnson and Johnson (199) co-operative learning promote more positive attitude towards the instructional experience than competitive individualistic methodologies. Cooperative learning is the use of small groups so that student's work together to minimize their own and each other's learning. According to Slavin (1990) there are two major theoretical perspectives related to cooperative learning- motivational and cognitive. The motivational theories of cooperative learning focus on reward and goal structure. One of the elements of cooperative learning is positive interdependence where students perceive that their success or failures lies within their working together as a group (Thomas 2001; Johnson, Johnson and Hollubec, 2008). From a motivational perspective — cooperative goal structure creates a situation in which the only way group members within can attain their personal goals is if the group is successful (Slavin 1990). Therefore, in order to attain their personal goals, students are likely to encourage members within the group to do whatever help the group to succeed one another with a group task. According to Johnson, Johnson and Hollubec (1986), there are three types of cooperative learning namely, formal cooperative learning, informal cooperative learning and cooperative based group learning. Formal cooperative learning consists of students working together for one class period to several weeks to achieve learning shared and complete jointly specific tasks and assignments. In formal co operational learning, the teachers' roles in making pre-instructional decision includes: to formulate both academic and social skills objectives, decide on the size of the groups, choose a method for assigning students to groups, decide which role to assign group members, arrange room and arrange the materials students need to complete the assignments. In these pre-instructional decisions, the social skills objectives specify the interpersonal and small group skills students are to learn. By assigning students roles, roles interdependence is established. The way in which materials are distributed can create resource interdependence. The arrangement of the classroom can create environmental interdependence and provide the teacher with easy access to observe each group which increases individual accountability and data for group processing.

Informal cooperative learning consists of having students work together to achieve a joint goal in temporary and ad hoc groups that last from a few minutes to one class period (Johnson, Johnson and Stanne, 2008). During teaching or demonstration or informal cooperative learning can be used to focus student attention on the material to be learned, set a mood conducive to learning, help set expectations as to what will be covered in a class session, ensure that students cognitive process, and rehearse the material being taught, summarize, what was learned in the next session and provide closure to an instructional session. The teacher's roles for using informal cooperative learning to keep students more actively engaged intellectually entails having focused discussions before and after the lesson (i. bookends) and interspersing paired discussions throughout the lesson. Two important aspects of using informal cooperative learning groups are (a) to make the task and the instructions explicit and precise (b) to require the groups to produce a specific product (such as written answers). The procedures are as follows:

(1) Introductory focused discussions. The teacher assigned students to pairs and explain the task of answering the question in five minutes time period and positive goal interdependence of reaching consensus. The discussion task is aimed at promoting advance organizing of what the students know about the topic to be presented and establishing expectations about what the lesson will cover. Individual accountability is ensured by the small size of the group. A basic interaction pattern of eliciting oral, high level reasoning and consensus building is required.

(2) Intermittent focused discussions: Teacher divides the lesson into 10 to 15 minutes segments. This is about the length of time a motivated adult can concentrate on information being presented. After each segment, students are asked to present next to them and work cooperatively in answering a question that requires students to cognitively process the materials just presented. The procedure is to ensure that each student formulates his or her answer. Students share their answers with their partners. Students listen carefully to their partner's answer. The pairs create a new answer that is superior to each member's initial formulation by integrating the two answers. Building on each other's thoughts and synthesizing the questions may require students to summarize the material presented, give a reaction to the theory, concepts or information presented, predict what is going to be presented next, hypothesize, solve a problem, relate material to past learning, integrate it into conceptual framework and receive conceptual conflict created by the presentation. Teacher should ensure that students are seeking each agreement on the answers to the question. Randomly choose two or three students to 30 second summaries of their discussions. Such individual accountability ensures that the pairs take the tasks seriously and check each other to ensure that both are prepared to answer (Slavin 1990).

(3) Choose focused discussions: Teacher gives students an ending discussion task lasting four to five minutes. The task requires students to summarize what they have learned from the lecture and integrate it into existing conceptual frameworks. The task may also point students towards what the homework will cover or what will be presented in the next class session. This provides closure to the lesson. Information cooperative learning ensures students are actively involved in understanding what is being presented. It also provides time for teacher to move around the class listening to what students are saying. Listening to students' discussions can give the teacher directions and insight into how well students understand the concepts and material as well as increase the individual accountability of participating in the discussions (Slavin 1990)

Ebuoh (2010) further indicated that when the Biology instructional methods are dull, confusing, and trivial and sometimes less meaningful, and narrow demands on students' intelligence, capabilities and talents, learning is bound to be stunted, if it occurs at all. The problem of low achievement in Biology at secondary school level has always been attributed to the teachers' failure to use appropriate instructional methods in teaching the subject. Sequel to the above, Biology teachers have tried varieties of instructional methods at their disposals. This underscores the need, to explore the effects of formal and informal cooperative learning methods in enhancing achievement in Biology in secondary schools.

Cooperative learning methods is another teaching method found efficacious by Idoko (2010) among group of 200 SSS 2 secondary school students in an experimental study. In the study, the students taught with Cooperative learning methods performed significantly better than those with school group competitive method. However, some of the teaching methods adopted have been criticized and seen not to be effective for the teaching of some aspects of secondary school Biology. The question then is, will the use of formal and informal cooperative learning methods in teaching Biology in Biology instruction help in improving the teaching and learning of Biology? Will the use of formal and informal cooperative learning methods make Biology

teaching bright, clear, important and also, much meaningful on students intelligence, capabilities, talents and improve achievement in Biology. The achievement of students in Biology is closely related to the use of method of teaching. For instance, McLuchan and Flore (1990) pointed out that no real education may take place without appropriate method. Consequently, the work investigated the level of students' achievement when formal and informal cooperative learning methods are used in the teaching of Biology in Secondary Schools in Enugu East Local Government Area of Enugu state.

The researcher observed that the Biology teachers neglect the use of vital methods of teaching Biology such as formal and informal cooperative learning methods in secondary schools in Nigeria. This ugly trend could have led to the students' poor achievement in Biology in senior secondary school certificate examinations in Nigeria. Furthermore, this unfortunate situation of not using formal and informal cooperative learning methods could have been contributed to the students dwindling performance in Biology. Consider for instance, in 2913) out of 1,0120 candidates who sat for senior secondary school certificate examinations in Biology in Enugu East Local Government Area of Enugu State only 10% passed at credit level (West African Examination Council, 2013). It appeared that in Nigeria, teachers are more conversant in using cooperative learning methods than formal and informal cooperative learning methods in teaching. A question that arises then is: is the use of the cooperative learning methods better than the use of formal and informal cooperative learning methods in achieving higher performance in Biology in secondary schools. Moreover, it is not certain which methods of teaching is associated with student's higher achievement in senior secondary school Biology with particular reference to the use of formal and informal cooperative learning methods.

Purpose of the Study

The purpose of the study was to find out the different between the mean achievement scores of students taught biology using formal and informal cooperative learning methods in secondary schools.

Research Question:

The following research question guided the study:

1. What is the difference in the mean achievement scores of students taught Biology using formal and informal cooperative learning methods in secondary schools?

Research Hypothesis:

The hypothesis (Ho) was tested at 0.05 level of significance.

1. There is no significant difference in the mean achievement scores of students taught Biology using formal and informal cooperative learning methods in secondary schools.

Method:

The design for this study is quasi-experimental. The design is specifically a pretest post-test, non equivalent group design. The choice of this design agrees with Abimbade (1997) 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 which are randomly assigned to experimental groups I and II respectively. The area covered by this study is Enugu East Local

Government Area of Enugu State. The population for this study comprised all the 1068 SS 2 biology students in all the eleven secondary schools in Enugu East Local Government Area.

Stratified simple random sampling technique was used to draw three schools from the eleven secondary schools in Enugu East Local Government Area. In each of the sampled schools, simple random sampling was used to pick two intact classes of SS2 in each school. Two intact classes were randomly assigned to the experimental group I and II. In all, a total of 270 students were used in experimental groups. In each school, an intact class of 45 students was assigned to experimental groups I and II respectively, making a total of 90 students. Biology Achievement Test (BAT) developed by the researcher was used for data collection. The number of periods that essentially covered 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 validity content validation. 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 administered to two intact classes of 40 students each at Community Secondary School Amasiodo Oghe in Ezeagu Local Government Area of Enugu State. The BAT was re-administered to the students and data collected. Then the two sets of scores from first and second administrations of BAT were correlated using the Pearson-product moment correlation. A correlation co-efficient value of 0.89 was obtained.

Two Biology teachers from each of the three sampled schools received training for a period of one week from the researcher on the use of formal and informal cooperative learning methods in teaching Biology respectively. After the pre test, the teachers provided treatment to the students for a period of four weeks. That is the teaching of the topics using the formal and informal cooperative learning method. There are some extraneous or confounding variables that the researcher felt could constitute potential threats to the validity, reliability and generalization of the results of this study. Such variables included inter-group variables, teacher variables and Hawthorne effects. In seeking to achieve validity, the following measures were taken to ensure that these confounding or intervening variables, which might introduce bias into the study, were either minimized or controlled.

BAT was administered respectively as pretests on the first week of treatment by research assistants. Scores of the students on the pretests was 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 pre-tests and post tests were recorded separately. The test items on BAT were scored and two marks were allocated to each number to give a maximum mark of sixty. Mean (\bar{x}) and standard deviation were used in analyzing the research questions.

Results:

Table 1: Mean Achievement Scores And Standard Deviation Of Students Taught Biology Using Formal And Informal Cooperative Learning Methods.

Groups	Mean (X)		Standard Deviation		N
	Pretest	Posttest	Pretest	Posttest	
Experimental Group I (formal cooperative)	22.34	54.71	6.06	4.13	135
Experimental Group II (informal cooperative)	22.08	63.07	5.06	3.88	135
Total					270

The result in table 2 above showed that the experimental Group II taught Biology using informal cooperative learning method achieved higher than those taught Biology using formal cooperative learning method.

Table 2: Analysis of Covariance of students overall mean achievement through the use of formal and informal cooperative learning methods in teaching Biology

Source of variation	Sum square	D f	Mean square	F-Cal	Significance	Decision
Covariance variation	7163.867	1	7163.867	107.629	000	
Main effect	16830.993	3	8415.496	252.867	000	
Teaching methods	2698.077	2	2698.077	43.036	000	Significance
Error	19102.931	287	66.561			
Residual	10126.312	4	2531.578	38.034		
Total	55922.18	303	20875.579			

S = Significance at $P < 05$

From the result in table 2 above, the F-calculated, F (43.036), is greater than the 0.000 computer significance level. Thus, the null hypothesis of no significant difference in the mean achievement scores of SS2 students taught using formal and informal cooperative learning methods in teaching Biology was rejected at 0.05 level of significance.

Discussions of Findings

This implies that the use of teaching method in teaching Biology influence significantly students' achievement in Biology. Similarly, it is in agreement with Okafor, (2000) who observed that the quality and method of teaching affects the students' performance in Geography. The researcher therefore concluded that there was a significant difference in the mean achievement scores of students taught with formal and informal cooperative learning methods in favour of informal cooperative learning method followed by formal cooperative learning method. The result of the study is in agreement with the findings of Amulu (2012) where cooperative learning method was found to be more efficacious than the use of project in teaching 200 SS2 students Introductory Technology in secondary schools in Ezeagu Local Government Area of Enugu State.

Conclusion

The result of the findings showed that experimental group I taught biology using informal cooperative learning method achieved higher than those taught biology using formal cooperative learning method. Furthermore, the researcher found out that there was significant difference in the mean achievement scores of students taught with informal and formal cooperative learning methods in favour of informal cooperative learning method followed by formal cooperative learning method.

Recommendations:

Based on the findings of the study, the following recommendations were made

1. The serving teachers of Biology in secondary schools should adopt the use of informal cooperative learning method in teaching Biology lessons than formal cooperative learning method.
2. In-service programmes should be made to emphasize the need to teach the subject (Biology) using informal cooperative learning method and formal cooperative learning methods.

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