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Effect of Group Investigative Laboratory Strategies on Students' Achievement in Biology

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Researchers and scholars in the field of education have suggested a shifting focus from conventional strategies to student centered strategies such as Group Investigative Laboratory strategies. Studies have shown that these teaching strategies are influential in determining students' achievement in Biology. The present research involved the effect of Group Investigative Laboratory strategies, on students' achievement in Biology. The study adopted a pretest, posttest, control group, quasi-experimental research design. 157 senior secondary school students participated, with nine intact classes from nine schools from three local government Area of Oyo state. Two research Hypothesis was tested at 0.05 Alpha level, Five instruments used in the study were: Four instruments used for this study and they were; Biology Achievement Test (BAT), Teachers' Instructional Guide on Group Investigative Laboratory Learning Strategy (TIGGILLS), teachers' Instructional Guide on Conventional Lecture Method (TIGCLM), evaluation Sheet to Assess Teachers' Performance (ESAT). Data were analyzed using ANCOVA. There was a significant main effect of Treatment groups on the students' post test Achievement scores ($F(2,139) = 32.559$, $P < .05$, $\eta 2 = .321$). Group investigative strategy was significantly different from the conventional strategy in their achievement scores. The exposure of the learners to Group Investigative Laboratory strategies have been found to positively affects the enhancement of students' achievement in Biology.

Keywords: Group investigative strategy, Achievement, Gender and Biology.

INTRODUCTION

Science is a search for evidence in order to answer questions or problems. Since solutions to problems can have more than one answer, this challenges students to solve problems by observing and collecting data and constructing inferences from those data, through this process, students also acquire knowledge and develop a rich understanding of concepts, principles, models, theories and skills. In present age of science and technology when scientific knowledge has grown exponentially, technological innovations have progressed at a rapid pace, and the effects of science and technology are clearly witnessed in all aspects of our lives, it is obvious that science and technology plays a key role in the futures of societies (Aydoğdu, 2006). According to Okeke (2007), science and technology are like two inseparable twins. The British Science Council (2009) defined science as the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence. Okeke (2007) defined technology as the process of devising and utilizing techniques to convert resources to material objects.

There are three main branches of science, they are; Life Sciences; Earth Sciences and Physical Sciences. The life sciences deal with the study of living things, their parts and interactions, for example Biology; zoology; botany. The earth sciences deal with the study of the Earth, other planets and space, for example; Astronomy. While the physical sciences deal with the study of matter and energy and their relationship. Examples of subjects under these are; Physics; Chemistry; Engineering. Nwagbo and Chukelu (2011) science and technology, therefore, is receiving much emphasis in education because of its significance and relevance to life and society. Their importance in this our modern world cannot be left out whether in the area of transportation, communication, security, banking, healthcare or entertainment, they all rely on science and technology in one way or another. The study of biology is essential for the nation's scientific and

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technological development (Nwagbo and Chukelu, 2011). According to the National Association of Biology Teachers (2005) Biology is defined as the study of life and its evolution, of organisms and their structures, functions, processes, and interactions with each other and with their environments. Biology as one of the science disciplines that deals with the study of living organism. By studying biology, the individual studies him or herself and other organism as living things, the interaction between them and the non-living things. Such knowledge is used to better the life of the individual. Biology is a vast and eclectic field, composed of many branches and sub-disciplines, these include; Evolutionary; Genetics; Molecular biology; Ecology; Physiology; Anatomy (Yadav and Mishra, 2013) the importance accorded biology in the school curriculum from senior high level to tertiary level reflects accurately the vital role played by the subject in contemporary society. The importance of the subject is not restricted to the development of the individual alone, but for the advancement of the social, economic and political goals of countries all over the world.

The general goals of Biology teaching is to equip the learner with the basic knowledge, skills and attitude that will enable one to lead an independent and useful life, both to himself/herself and the larger community in which she/he lives. Furthermore, one primary function of Biology teaching is to help the students understand biology concepts, principles, theories and laws. Hence Federal Ministry of Education (FME, 2009), spells out the major objectives of the biology curriculum as:

1. Understanding of the structure and function of living organisms as well as appreciation of nature;
2. Acquisition of adequate laboratory and field skills in order to carry out and evaluate experiments and projects in Biology;
3. Acquisition of necessary scientific skills, for example, observing, classifying and interpreting biological data;
4. Relevant knowledge in Biology needed for future advanced studies in biological science; acquisition of scientific attitude for problem solving;
5. Ability to apply biological principles in everyday life in matters that affect personal, social, environmental, community health and economic problems.

Achieving these objectives therefore means that every citizen must be taught the subject to understand and master all the concepts. Biology as one of the prerequisite subjects for many fields of learning contributes immensely to the technological growth of the nation. These include medicine, forestry, agriculture, biotechnology and nursing as expressed by (Yusuf and Afolabi, 2010). But in recent times, observations on students' academic performance in Biology, over the years in results of the Senior Secondary Certificate Examination (SSCE) conducted by West African Examination (WAEC) and National Examination Council (NECO) revealed that a very few number of students perform better in Biology examination compared with other subjects, and as a result affected the academic aspirations of many candidates.

Table 1 reveals that the percentage of students that passed biology at credit level and above (A1-C6) was consistently less than 50% for the past 11 years (2002-2013) in Nigeria except the past year where it was 52.65%. This situation is particularly disheartening when we realize that the success of our nation in science and technology depends to a great extent on the mastery of this fundamental aspect of science. Also, according to the WAEC Chief Examiner's Report (WAEC 2010; 2011 and 2012), the senior secondary school biology candidates' have a number of problems associated with both cognitive and motor skills which have culminated in the poor performance of students in the certificate examinations (Umoke and Nwafor, 2014). Senior Secondary Certificate Examination (SSCE) results have revealed that students perform poorly in science subjects particularly in Biology. Besides, research carried out by Ogong (2006), supported the claim of a low level of performance in science subjects in institutions of learning in Nigeria. Records have also shown that even in schools where necessary facilities for the teaching and learning of science are available; students still perform poorly in Biology. This poor performance has been attributed to a number of factors. Some of the factors, according to West African Examination Council (WAEC) Chief Examiner's Reports, examined over the years (2003-2013) are non–adherence to rubrics, wrong spelling of labels and technical terms, shallow knowledge of the subject matter, inability to properly express themselves in English Language and inability to properly describe experimental procedures involved (Chief Examiner's Report WASSCE, 2012)

Moreover, the desire to know the causes of the poor performance in Biology has been the focus of other researchers like Gambari, Isiaka, Emmanuel and Ikusanu, (2014), they observed that poor performances in the sciences are caused by the poor quality of science teachers, overcrowded classrooms, and lack of suitable and adequate science equipment, among others, this is corroborated by Kareem, (2003). A recent study has revealed that many aspects of school science (Biology included) pose problems of understanding for students, because of the teaching strategies employed including lack of adequate instructional resources (Kolawole, 2007). Consequently, many students fail to perform well in science because of their inability to organize materials sufficiently in the time allowed for the study and retention Students perform poorly in Biology because Biology classes are usually too large and heterogeneous in terms of ability level (Prokop, Leskova, Kubiatko, and Diran. 2007). In addition, the laboratories are ill-equipped and the Biology syllabus is overloaded, it is therefore pertinent to look for variables that could be manipulated to rectify this situation and subsequently find their effects on learning outcomes. In the same vein, other factors enumerated for failure in Biology according to Chief Examiner's Report on Biology in November/December (2007:180) include drawing of poor diagrams with loss of details, non conformity to size specifications in diagrams, wrong spellings of labels, omission of titles to diagrams, poor handwriting making their work illegible, poor numbering of questions, inability to relate structure to function, not writing magnification to diagrams, guidelines drawn with free hand and crossing each other. (May/June 2007 WASSCE Report)

Some of the remedies suggested to overcome the factors for failure by the same WASSCE Chief Examiner's Reports over the years include the following. Candidates should prepare adequately for examinations (May/June 2012), teachers should teach candidates to draw biological diagrams according to the rules and regulations, (May/June, 2007), Biology teachers should make lessons lively with the use of pictorial charts and models in teaching. Students should also be exposed to practical classes. Teachers should endeavour to complete the syllabus before the examinations (May/June 2012). Insufficient resources for the teaching and learning of science constitute a major cause of student underachievement. These insufficient resources include laboratories, science equipment, and specimens to be used as teaching aids (Akinbobola and Ado, 2007). Shortage of qualified and

dedicated teachers as the factor affecting student performance in science and that poor practical orientation will lead to poor understanding of the theory. In (Ezenwosu, S. U and Nworgu, L. N. 2013).'s opinion teachers are no more dedicated to their assignments; they give more time to trader, petty contracts, farming, etc. They sneak in and out of the classrooms and laboratories at will. There are many causes of mass failure of students in senior secondary Biology Examination. Some of them are enumerated below as cited by Gbaje (2007). Structuring of the curriculum, the concentration of examination questions on a few topics and the inability of students to perform enough practical before their examination. Other reasons given by Gbaje, (2007) include most of the textbooks used in secondary schools are written by foreign authors, languages used in some of the texts are complex and ambiguous, and hence, it becomes difficult for students to comprehend. Many secondary school students are unfamiliar with more than half of laboratory apparatus and are unable to know in what experiment they are used, (Aydogdu and Kesercioglu, 2005), and learner variables such as gender stereotype and teacher's methodology, (Jimoh, 2004).

Several studies have been conducted in and outside the shores of this country to investigate the causes of students' poor academic achievement in Science and in Biology (Umar, 2011) and the most recurring factors in all the reports were; inefficient teaching strategy employed by the teachers, which is the conventional teaching strategy. A group investigation learning strategy was developed by Sharan and Sharan,(1992) it emphasizes more student choice and control than do other cooperative methods. It has a strong foundation in John Dewey's philosophy of education where he believed that the students would have experienced meaningful learning if they have been exposed to the stages of scientific inquiry. So, this would help students "learn how to learn" (Sharan and Sharan, 1992). In group investigation, students form groups within which to plan and implement an investigation, and synthesize the findings into a group presentation for the class (Tan, Sharan, and Lee, 2006). The teacher's general role is to make the students aware of resources that may be helpful while carrying out the investigation. Researchers have reported, with a high degree of consistency, the effectiveness of the group investigation in achieving positive learning outcomes in several domains (Mayasari, 2012) used group investigation combined with other strategies in high school classrooms in their respective work and found that students from the group investigation settings were superior to those taught by whole-class methods in terms of academic achievement of learners.

The persistent use of conventional method makes students passive rather than active learners. It does not promote insightful learning and long term retention of any abstract concepts in biology, and emphasizes learning through the teacher's guidance at all times (Gambari, Yaki, Gana and Ughovwa, 2014). Okoli (2006) indicated that many science teachers prefer the traditional expository/lecture method of teaching that is, a teaching technique where one person, the teacher, presents a spoken discourse on a particular subject and do away from activity oriented teaching methods which are student centered (such as inquiry method, the discovery method, investigative laboratory approach). Nwagbo (2006) also observed that such teacher-centered approach which places the teacher as the sole possessor of knowledge and the students as passive recipients of knowledge may not enhance achievement or promote positive attitudes to biology others are attitudes, availability of laboratory facilities and gender. The search for a more effective approach for the teaching and learning of biology that will enhance the achievement has persisted over the years. This is because, the achievement is the basis for scientific inquiry and the development of intellectual skills that is needed to learn concepts (Nwagbo & chukelu, 2011) but there is little empirical evidence so far, on effects of investigative laboratory activity approach on students' achievement. Gender issues and academic achievement become a very important issue among researchers in science, but yet no consistent result had emerged. According to Achor, Wude and Duguryil (2013) gender stereotypes seem to be a major impediment to the achievement. Oludipe, (2012) agreed that gender bias is very prevalent in Africa and particularly Nigeria. He argued that in Nigerian, harder tasks are assigned to males while females are given the relatively easy and less demanding tasks. This problem also exists in our schools where Gbaje (2007) says teachers maintain gender stereotypical view of their students and thereby perceives science as being difficult for the female students.

Statement of the Problem

This study was embarked upon in order to investigate the effects of group investigative laboratory learning strategies for the students' academic achievement in Biology. The study would further explore the extent to which the moderating effect of students' gender differences in the students' academic achievement in Biology.

Hypotheses

The following null hypotheses will be tested in this study at $p<0.05$ level of significance:

H01: There will be no significant main effect of treatment on students' achievement in biology

H02: There will be no significant main effect of gender on students' achievement in biology

METHODOLOGY

This study adopted pretest, posttest, control group, quasi-experimental design. Two hundred and forty participants consisting of senior secondary school two (SSII) students from intact classes were randomly selected from two Local Government Areas of Oyo state. The schools were randomly assigned the experimental and control group

Research Instrument

Five instruments used for this study were;

1. Biology Achievement Test (BAT)
2. Teachers' Instructional Guide on Group Investigative Laboratory Learning Strategy (TIGGILLS)
3. Teachers' Instructional Guide on Conventional Lecture Method (TIGCLM)
4. Evaluation Sheet to Assess Teachers' Performance (ESAT)

Biology Achievement Test (BAT)

This will make up of two sections.

Section A: This consists of the personal data of the subjects containing their name, gender, school etc.

Section B: This consists of 25 multiple choice items with four portions. All the questions will be answered by the participants. The table of specification for the development of the test is in on the table 3.2. The table is in accordance with Okpala and Onocha (1995) in which the six levels of Bloom taxonomy is reduced to three levels.

Table 1: Statistics for entries and result for May/June WASSCE biology for 2003-2013

Year	Total Entry	Total sat	Credit Passes 1-6	Percentage Passes
	No of Candidates	No of Candidates	No of Candidates	% of Candidates
2002	1,240,163	882,119	278,112	31.52
2003	1,006,831	909,101	392,249	44.15
2004	1,005,553	1,027,938	253,487	24.69
2005	1,080,162	1,072,607	375,850	35.04
2006	1,170,522	1,152,045	559,854	48.60
2007	1,270,137	1,238,163	413,211	33.37
2008	1,292,910	1,259,964	427,644	33.94
2009	1,372,567	1,340,206	453,928	33.87
2010	1,331,381	1,300,418	427,644	33.90
2011	1,540,141	1,505,199	579,432	38.50
2012	1,695,878	1,672,224	649,156	38.82
2013	1678154	1646741	850706	51.66

Source: Statistics Section, West African Examination Council (WAEC) National Office, Onipanu, Lagos, Nigeria

Table 2: Specification of BAT

Biology Topics	Knowledge	Understanding	Thinking	Total
Ecology	2, 11, 14, 17	4, 19	6	7
Population	10, 13	1, 16, 20	7, 18	7
Succession	8, 9, 12	3	5, 15	6
Total	9	6	5	20

Table 3: Posttest achievement scores of students by treatment and Gender in Biology

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.	Eta^2/ Effect
CORRECTED MODEL	835.751[a]	18	46.431	12.138	.000	Size
INTERCEPT	2214.515	1	2214.515	578.926	.000.	.613
SCORE1	24.432	1	24.432	6.387	013	.808
TREATMENT	249.093	1	249.093	32.559	.000	.044
GENDER	2.804	1	2.804	.733	.393	.0321
ERROR	527.879	139	5.962	.709	.494	.005
TOTAL	31495.000	157	3.825	1.559	.189	.010
CORRECTED	1363.631	156				.043

R-squared = .613 (Adjusted R Squared = .562)

The result in table 3 shows that there was a significant main effect of Treatment groups on the students' post test Achievement scores ($F(2,139) = 32.559$, $P < .05$, $\eta 2 = .321$). The effect size of 32.1% was fair. Therefore null hypothesis is rejected. This means that there was a significant difference in the mean achievement scores of subjects exposed to treatment. To find out the magnitude of the mean scores of the group's performance the table 3 is presented as follows:

Table 4: Estimated Marginal Means of Posttests Achievement Scores by Treatment Group on Students Achievement

Treatment Groups	N	Mean	.Std Error
Group investigative Strategy	88	15.63	.489
Conventional Strategy	69	11.25	.444

From the above table 4, Group investigative Learning Strategy had the highest mean score of ($\bar{x}$ = 15.63) followed by Conventional Strategy ($\bar{x}$ = 11.25).

Validity and Reliability of Biology Achievement Test (BAT)

This instrument was subjected to face and content validity by giving copies to experts in education, science education and biology education. These experts determined its suitability for the targeted population in terms of clarity, breath and language. The reliability co-efficient of the instrument determined using Kuder–Richardson formula 20 was 0.83. The average difficulty and discriminating indices of each of the test items computed to validate the instrument was 0.43.

Teacher Instructional Guide on Group Investigative Laboratory Learning Strategy (TIGGILLS)

Step 1: Class is organized into groups of six
Step 2: Groups plan their investigations
Step 3: Groups carry out the investigation
Step 4: Groups plan their presentations
Step 5: Groups make their presentations and their new experiences

Validity of Teacher Instructional Guide on Group Investigative Laboratory Learning Strategy (TIGGILLS)

This contained the roles of the teacher and the students in Group Investigative Laboratory Learning situation. Expertise in the field of educational psychology that is knowledgeable in group investigation learning strategy did the face validity while experts in biology education also did the editing of the guide. The observations and comments of these experts were taken into consideration while preparing the final draft.

Teachers' Instructional Guide on Conventional Lecture Method (TIGCLM)

Here, students sit individually throughout the lesson. The treatment for each lesson is in the form of lectures.
Step 1: The research assistant presents the lesson in the form of lectures
Step 2: Students listen to the teacher and write down chalkboard summaries.
Step 3: Students ask the teacher questions on areas of the topic that is not clear to them.
Step 4: Students answer the teacher's questions individually.
Step 5: Students are given a take home assignment.

Validity of Teachers' Instructional Guide on Conventional Lecture Method (TIGCLM)

This contained the roles of the teacher and the students in a conventional lecture learning situation. Experts in the field of education did the face validity while experts in biology education did the editing of the guide. The observations and comments of these experts were taken into consideration while preparing the final draft.

Evaluation Sheet to Assess Teachers' performance on the use of the Strategies (ESAT)

This is the guidelines for evaluating the performance of the trained teachers on the effective use of these strategies
(1) Group Investigative Laboratory learning strategy
(2) Conventional Lecture Method
This is a rating scale that will be made up of two sections
Section A – This consisted of the personal data of the trained teacher containing name, school, period, class taught, date and the summary of the concept discussed in the class.
Section B - This consisted of items were evaluated. The scoring of ESAT will be on points.

Validity and Reliability of ESAT

The instruments were tested to ensure its reliability. For the purpose of validation, expert's attentions were drawn to ascertain the appropriateness of the concepts and methods to the target population. The reliability coefficient of 0.82 and 0.81 were obtained for Group Investigative Laboratory Learning strategy and conventional strategy respectively.

Procedure for data collection

The procedure for data collection will be in three main phases and it will last for eight weeks. The phases were:

- Visitation to the schools for one week
- One week for pre- test
- Training of teachers (research assistants) for two weeks
- Six weeks of treatment using the research assistant on the listed strategies. This takes place simultaneously in all the school selected.
- One week for post - test

(Prior to the collection of data, the participating teachers will be trained. The training program will last for two weeks. The training of the teachers will focus on the use of Group investigative laboratory strategy and conventional lecture method.)

Pretest

The instrument biology achievement test was administered before the treatment

Treatment

I Experimental group 1

Treatment in this group involved Group Investigative Laboratory Learning strategy in the following steps:
Step 1: Class is organized into research groups
Step 2: Groups plan their investigations
Step 3: Groups carry out the investigation
Step 4: Groups plan their presentations
Step 5: Groups make their presentations and their new experiences
Step 6: The research assistant and students evaluate their work

II Control group

Here, students sit individually throughout the lesson. The treatment for each lesson is in the form of lectures.
Step 1: The research assistant presents the lesson in the form of lectures
Step 2: Students listen to the research assistant and write down chalkboard summaries.
Step 3: Students ask the teacher questions on areas of the topic that is not clear to them.
Step 4: Students answer the research assistant's questions individually.
Step 5: Students are given a take home assignment.

Post test

After six weeks of treatment, post-test will be administered on the experimental and the control groups. Biology Achievement Test (BAT) was re-administered.

Procedure for Data Analysis

Analysis of data collected in relation to this study will be done using Descriptive Statistics (mean, standard deviation) including Bar charts to explain the mean distribution of the various groups (Treatment, Gender and Attitude to science),
The data will also be analyzed using inferential statistics of Analysis of Covariance (ANCOVA) of the post-test scores with the pretest scores as the covariates. Estimated Marginal Means will be used to determine means of different groups.

RESULTS

$H0_1$: There is no significant main effect of treatment on students' achievement in Biology
Ho2: There is no significant main effect of Gender on students' Achievement in Biology

The results in table 3 showed that there was no significant main effect of Gender on the Posttest Achievement results of students in Biology ($F(1,139) = .733$, $P > .05$, $\eta^2 = .005$). The effect size of 0.5% was negligible. Therefore, hypothesis 2 was not rejected.

DISCUSSION

There was a significant main effect of Treatment groups on the students' post test Achievement scores in Biology. Group investigative Learning Strategy had the highest mean score followed by Conventional Strategy. Researches supporting this finding has reported, with a high degree of consistency, the effectiveness of the group investigation in achieving positive learning outcomes in several domains (Oh and Shin (2005) used group investigation combined with a peer tutoring strategy in high school biology classrooms and found that students from the group investigation settings were superior to those taught by whole-class methods in terms of academic achievement, process skills, perceptions of learning environment, and self-esteem (Doymu§, Şimşek and Karaçöp, 2009). Consequently, Koc, Doymu, Karacop, and Slmekl (2010) also conducted a study to determine the effect of group investigation and jigsaw techniques on students' academic achievement in the chemical kinetics unit of a general chemistry course. This study included a total of 106 students studying chemistry in three different classes during the 2008-2009 academic years. One of these classes served as the investigation group, using group investigation, while the second served as the jigsaw group, using the jigsaw technique, and the third served as the control group, using the traditional teaching method. The main instruments used to obtain data were the Chemical Kinetics Achievement Test (CKAT) and Graphics Skills Test (GST), which were applied to the treatments groups. Based on the results of the research, it was concluded that the teaching of chemical kinetics via the jigsaw and group investigation techniques was more effective in increasing academic achievement compared to the traditional teaching method.

Moreover, Mayasari (2012) in his own separate study investigated the implementation of group investigation to improve students' writing organization of analytical exposition text and to what extent is the improvement of students' writing organization of analytical exposition text after being taught through group investigation. This study employs a classroom action research with 11th Grade students of MA Manahijul Huda Pati in the Academic year of 2011-2012. The instrument used to collect the data was observation and test. The assessment of the test result was focused students' ability in writing analytical exposition. The result shows that the implementation of Group investigation is improvement of learning tools, motivates students in doing work. Also, Ufuk *et al.,* (2013) examined the effects of Group Investigation (GI) and the Reading-Writing- Presenting (RWP) method in cooperative learning on students' comprehension of the social psychology lesson. This research included 107 first-grade students from two classes. For this research, each class was selected to test one teaching method. The first class was selected as the Group Investigation Group (n=52), the second was selected as the Reading-Writing-Presenting Group (n=55). The data were collected through the Academic Achievement Test. The results obtained from the data show that the Reading-Writing-Presenting method has a more positive effect on increasing students' academic knowledge and achievements in the social psychology lesson than the Group Investigation method.

In a study conducted by Omiola, Enuwa, Awoyemi and Adebayo (2012) to assess the effectiveness of blended learning and individualized instructional strategy on the cognitive learning outcomes in Basic Technology. The sample they used for the study is a quasi-experimental consisted of 364 Junior Secondary School students drawn from Secondary Schools in Ilorin Metropolis. Two hypotheses were postulated and tested using Analysis of variance (ANOVA) and Turkey/Kramer post hoc test and mean. The results of the study revealed that, there was a significant difference in the students' cognitive achievement and interest in Basic Technology which were mostly enhanced by the blended learning strategy, followed by the conventional strategy.

Educational Implications

The exposure of the learners to Group instruction strategy has been found to positively affect the enhancement of students' achievement in Biology. The findings have therefore revealed the importance of using teaching strategies that are participatory and learner centered where learners are trained to take control and direct their learning processes for effective learning. The study also revealed that there is a need to incorporate into our educational system the Group and individualized instruction strategies could help in providing necessary achievement needed to bring about necessary outcomes in Biology.

CONCLUSION

The right selection and appropriate use of instructional strategies may result in better achievement on the part of the learners. The study had shown that Group and individualized instruction strategies were more effective in improving the students' achievement in Biology than conventional teaching strategy. The study found that Group instruction strategy was more effective than individualized instruction strategy. Hence, Group teaching strategy was more effective than both individualized instruction and conventional teaching strategy in teaching the selected concepts in Biology.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are hereby made:

- In order to improve students' achievement in Biology, Group and individualized instruction strategies are recommended to secondary school Biology teachers for the teaching of Biology.
- Students should be allowed to use their skills with all instructional resources in Biology classroom instruction in order for students to yield positive outcomes towards Biology.
- There is a need for training of pre-service Biology teachers on the effective use of the Group and individualized instruction strategies

- Government and professional bodies such as STAN, NTI, NUT, etc. should organize in-service and re-training programmed for teachers on the effective use of the Group and individualized instruction strategies in the teaching Biology.

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