EFFECTS OF SMALL GROUP AND PEER TUTORING TEACHING STRATEGIES ON STUDENTS' ACHIEVEMENT AND RETENTION IN SECONDARY SCHOOL BIOLOGY IN DELTA STATE

BY

JUWETO, Akporoghene Godfrey

DELTA STATE UNIVERSITY,
ABRAKA.

JULY, 2018.

TITLE PAGE

EFFECTS OF SMALL GROUP AND PEER TUTORING TEACHING STRATEGIES ON STUDENTS' ACHIEVEMENT AND RETENTION IN SECONDARY SCHOOL BIOLOGY IN DELTA STATE

BY

JUWETO, Akporoghene Godfrey
PG/12/13/213809
EDSU, EKPOMA B.Sc (Ed) 1997
DELSU, PGDE 2005
DELSU, M.Ed 2012

A Ph.D Thesis Submitted to Post Graduate School in Partial Fulfilment of the Requirements for the Award of the Degree of Doctor of Philosophy (Ph. D) Curriculum and Instruction

Delta State University, Abraka.

JULY, 2018.

DECLARATION

I hereby declare that this project work was solely written by me, it is a record of my own research that has never being seen, carried out or presented in any previous application to the award of Ph. D of any other University.

All citations and sources of information are clearly acknowledged by means of references.

_____

JUWETO, Akporoghene Godfrey

CERTIFICATION

We certify that this Thesis was carried out by Mr. JUWETO Akporoghene Godfrey in the Department of Science Education, Faculty of Education Delta State University Abraka.

_____ _____

Prof. Inomiesa, E.A **Date**
Supervisor

_____ _____

Prof. Ajaja, P.O **Date**
Supervisor

_____ _____

Prof. Ajaja, P.O **Date**
Head of Department

_____ _____

Prof. Enamiroro Patrick Oghuvbu **Date**
Dean, Faculty of Education

DEDICATION

This research work is dedicated to the memory of my beloved lost ones, my late father, the late Mr. A.K. Juweto, my Mother, Mrs. Cecelia Juweto and the late Dr. H. U. Mekako of blessed memories.

ACKNOWLEDGMENTS

I give the Almighty God all the glory and honour for His knowledge and wisdom, the only one who makes all things possible. May His name be praised forever.

My sincere gratitude also goes to my amiable and ever-scrutinizing supervisors, Prof. E. A. Inomiesa and Prof. O.P Ajaja, for their invaluable guidance and supervision in making this research work a success. Their meticulous and warm encouragements were key ingredients in motivating me in the right direction.

Very special thanks go to all the loving, caring, ever-scrutinizing and amiable lecturers and staff of the Department of Science Education: Prof. N. S. Okoye, Prof. E. Kpangban, Dr. T. E. Agboghoroma, Dr. S. B. Ijeh, Dr. E. O. Oyovwi, Dr. (Mrs.) J. I. Adjekpovu, Mr. S.E. Umudhe, Mr. B. I. Tabeta, Mr. I. N. Kainti and Mrs. H. Ogedegbe.

Special thanks go to my better half, my companion, my best friend, my confidant, my jewel of inestimable value, my very beautiful and ever supportive wife, Mrs. Mercy Juweto, and my children, Kelvin, Onome and Olivia, for their moral support and understanding in the course of this research work.

My sincere thanks also go to my elder brother and father, Engr. August Juweto, and my family members, Mrs. Valentina Aburim, Mekako Jude, Rev. father Mekako Francis, Mrs. B. O. Mekako, Chief & Chief Mrs. E. Juweto, Bar. Patrick Mekako, Mrs. Blessing Isebi, Engr. Tomame Mekako, Mrs. Harriet Ohre and (RTD) Major B. S. Ebiyebo, for their huge financial assistance in the course of my research.

My sincere gratitude goes finally to the Principals, Staff and students of the secondary schools used for the study. .

TABLE OF CONTENTS

COVER PAGE- - - - - - - - - - i

TITLE PAGE - - - - - - - - - - ii

DECLARATION- - - - - - - - - - iii

CERTIFICATION - - - - - - - - - - iv

DEDICATION - - - - - - - - - - v

ACKNOWLEDGMENTS - - - - - - - - - vi

LIST OF TABLES - - - - - - - - - - vii

LIST OF FIGURES-- - - - - - - - - viii

ABSTRACT - - - - - - - - - - ix

CHAPTER ONE: INTRODUCTION

Background to the Study: - - - - - - - - - 1

Statement of the Problem: - - - - - - - - - 11

Research Questions- - - - - - - - - - 12

Hypotheses- - - - - - - - - - - 14

Purpose of the Study- - - - - - - - - - 15

Significance of the Study- - - - - - - - - 16

Scope and Delimitation of Study- - - - - - - - 17

Limitations of the study - - - - - - - - - 18

Operational Definition of Terms- - - - - - - - 18

CHAPTER TWO: REVIEW OF RELATED LITERATURE

Theoretical Framework of the Study- - - - - - - - 21

Concept of Small Group Teaching Strategy in Biology- - - - - 24

Small Group Teaching Strategy and Tips for Inclusive Teaching of Biology- - 26

Structure of Small Group Task, Group Size and Group Composition- - 28

Benefit of Small Group Teaching- - - - - - - 30

Concept of Peer Tutoring Strategy- - - - - - - 31

Forms of Peer Tutoring Strategies and Teacher's Role- - - - 34

Organizational Dimensions in Peer Tutoring Strategy- - - - 39

Students Academic Achievement in Biology- - - - - - 43

Strategies for Students Retention in Small Group and Peer Tutoring - - 46

Effective Classroom Management for Achievement and Retention- - - 51

Benefits of Students Achievement and Retention in Tutors and Tutee- - - 53

Empirical Studies on Small Group Teaching Strategy- - - - - 56

Empirical Studies on Peer Tutoring Strategy- - - - - - 57

Appraisal of Literature Review- - - - - - - - 60

CHAPTER THREE: RESEARCH METHOD AND PROCEDURE

Design of the Study- - - - - - - - - - 62

Population of the Study- - - - - - - - 64

Sample and Sampling Techniques- - - - - - - - 66

Research Instruments-- - - - - - - - - 67

Validation of Research Instrument- - - - - - - - 68

Reliability of the Instrument- - - - - - - - - 71

Treatment Procedure- - - - - - - - - - 71

Method of Data Analysis- - - - - - - - - 74

CHAPTER FOUR: PRESENTATION OF RESULTS AND DISCUSSION

Answering of Research Questions and Testing of Hypotheses- - - - 75

Discussion of Results- - - - - - - - - 94

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of the Research- - - - -- - - - - 98

Findings- - - - - - - - - - - 102

Conclusion- - - - - - - - - - - 103

Contributions to Knowledge- - - - - - - - - 104

Recommendations - - - - - - - - - - 104

Suggestions for Future Research- - - - - - - - 105

REFERENCES- - - - - - - - - - 106

APPENDICES

Appendix I: Statistics for Entries and Results for May/June WASSCE

Biology 2000-2013- - - - - - - - - - 119

Appendix II: Student Biology Achievement Test (SBAT)- - - - - 120

Appendix III: Lesson Plan for Experimental Group I - - - - - 127

Appendix IV: Lesson Plan for Experimental Group II- - - - - 152

Appendix V: Lesson Plan for Control Group - - - - - - 178

Appendix VI: Construct Validity - - - - - - - - 204

Appendix VII: Reliability co-efficient for Student Biology Achievement

test (SBAT)- - - - - - - - - - 208

Appendix VIII: Criteria for Validating the Student Biology Achievement

Test (SBAT)- - - - - - - - - - 210

Appendix IX: Letter to Principals of Schools to be used for the Study- - 213

Appendix X: A Six Week Instructional Unit- - - - - - 214

Appendix XI: Students Biology Achievement Test (pre-test) and model Answers - 216

Appendix XII: Students Biology Achievement Test (post-test) and model Answers - 219

Appendix XIII: Students Biology Achievement Test (delayed-test) and model Answers - 222

Appendix XIV: Analysis of T-test of pre-test computation- - - - - 225

Appendix XV: SPSS Computation and Analysis of all Collected Data from the field 234

LIST OF TABLES

TABLES

1: Population by Senatorial Districts, Local Government Areas, Schools and Number of SSII Students - - - - - - 65

2: Sample Size Distribution showing No. of schools, No. of intact-classes, No. of students, No. of research assistants- - - - - - 66

3: Distribution of schools based on teaching method/strategies- - - 67

4: Biology Achievement of Secondary School Students Exposed to Small group, Peer tutoring and Lecturing teaching Methods of Teaching - - 75

5: ANCOVA: Test of Significant difference in the Biology Mean achievement of Secondary School Students Exposed to Different Methods of Teaching - - 76

6: Post Hoc Multiple Comparison across Different Groups- - - - 77

7: Mean and Standard Deviation: Biology Achievement of Secondary School Male Students Exposed to Different Methods of Teaching- - - - 78

8: ANCOVA: Test of Significant difference in the Biology Mean achievement of Male Secondary School Students Exposed to Different Methods of Teaching - - - - - - - - - - 79

9: Post Hoc Multiple Comparison across Different Groups of male Students- - 79

10: Mean and Standard Deviation: Biology Achievement of Secondary School Female Students Exposed to Different Methods of Teaching - - - 80

11: ANCOVA: Test of Significant difference in the Biology Mean achievement of Female Secondary School Students Exposed to Different Methods of Teaching- - 81

12: Post Hoc Multiple Comparison across Different Groups of Female Groups- 82

13: Biology Achievement of Secondary School Male Students Exposed to

Group Teaching Strategy- - - - - - - 83

14: t-test: of Differences between the mean Biology Achievement Test Score of Male and Female Students Exposed to Group Teaching Strategy- - - - - - - - - 83

15: Biology Achievement of Secondary School Male and Female Students Exposed to Peer tutoring teaching Strategy - - - - - 84

16: t-test: of Differences between the mean Biology Achievement Test Score of Male and Female Students Exposed to Peer tutoring Teaching Strategy- - - - - - - - - 85

17: Univariate Analysis of Biology Achievement by Teaching Strategy and Sex- - - - - - - - - 85

18: ANCOVA: Analysis of Covariance for Biology Achievement by different Teaching Strategies- - - - - - - 86

19: Mean and Standard Deviation: Retention Score of Secondary School Biology Students Exposed to Different Methods of Teaching - - - - - - - 86

20: ANOVA: Test of Significant difference in the Biology Mean Retention Scores of Secondary School Students Exposed to Different Methods of Teaching - - 87

21: Mean and Standard Deviation: Mean Retention Scores of Secondary School Male Biology Students Exposed to Different Methods of Teaching - - - 88

22: ANOVA: Test of Differences between the mean Biology Retention Score of male Students Exposed to Different Teaching Strategy - - - 88

23: Mean and Standard Deviation: Mean Retention Scores of Secondary School Female Biology Students Exposed to Different Methods of Teaching - - - 89

24: ANOVA: Test of Differences between the mean Biology Retention Score of male Students Exposed to Different Teaching Strategy - - - 90

25: Mean and Standard Deviation: Differences between the mean Biology Retention Score of Students Exposed to Small Group Teachings - - 90

26: t-test: Test of Significant Differences between the mean Biology Retention Score of Students Exposed to Small Group Teachings - - 91

27: Mean and Standard Deviation: Differences between the mean Biology Retention Score of Students Exposed to Peer Tutoring - - 91

28: t-test: Test of Significant Differences between the mean Biology Retention Score of Students Exposed to Peer Tutoring - - - - 92

29: Mean and Standard Deviation: Univariate Analysis of Biology Retention by Teaching Strategy and Sex - - - - - - 92

30: ANCOVA: Analysis of Covariance for Biology Retention by different Teaching Strategies - - - - - - 93

LIST OF FIGURE

FIGURES

1: Categories of Variables Impacting Students Academic Achievement- - - 45

ABSTRACT

This study investigated the effects of Small Group teaching and Peer Tutoring teaching strategies on students' achievement and retention in secondary school Biology in Delta State. A 2 x 3 x *3 pre-test, post-test control group quasi – experimental design consisting of three experimental groups-Small Group, Peer Tutoring and Lecture method was used. To guide the study, 12 research questions were raised, while 12 null hypotheses were formulated and tested at the 0.05 level of significance. The population consisted of six senior secondary classes II Biology students from six public schools in the three senatorial districts of Delta State. From there, a sample of two hundred and thirty eight (238) students was drawn. The sample consisted of one hundred and thirty five males (135) and one hundred and three (103) females. Data was collected through the use of the research instrument called the Students' Biology Achievement Test (SBAT). The reliability of the instrument was established using Kuder-Richardson 21 formula and a reliability co-efficient of 0.81 was obtained, showing that the instrument was reliable. Mean and Standard Deviation were used in answering all the research questions while Analysis of variance (ANOVA) and Analysis of covariance (ANCOVA) were used in testing the hypotheses. Also post-hoc multiple comparisons were carried, out using Bonfereni test to indicate the direction of the significant difference. The results indicated that students taught Biology using Small Group tutoring strategy achieved higher than those taught using Peer tutoring. The level of retention was higher in Biology students taught using the lecture method. However, there was no significant interaction effect between teaching strategies and sex. It was, therefore, recommended that Biology teachers should be more innovative and incorporate Small Group teaching in their mode of instruction in Biology lessons in secondary schools. The teacher education programme in Nigeria tertiary institutions should be improved upon to prepare teachers who can apply innovative and student-centred approaches (Small Group teaching) that will promote effective teaching and learning.*

CHAPTER ONE

INTRODUCTION

Background to the Study

Research works in Nigeria in recent times have relatively given much attention to teaching strategies as it affects the education system and classroom instruction but not much has been achieved in terms of practice and implementation by teachers in the classroom. Much criticism have trailed the constant low performance of science subjects in recent times in externally organized and conducted examination by the West African Examination Council (WAEC) and National Examination Council (NECO). Research findings have recognized unsuitable teaching strategies and methods among the factors as been responsible for the poor state of science achievement (Balogun, 1983). In this context, given the possible connection between science achievement and strategies and methods, it behooves on science teachers and science educators to devise and explore teaching strategies and methods among others factors that are effective and result- oriented for improving students achievement and understanding of science subjects, (Akinsola, 2002). Science, according to Njoku (2007) is the rational and sequential study of the environment through experimentation and observation in a view to understanding the environment, manipulating and controlling it for the betterment of human conditions.

Onwuakpa and Nweke 2000, (as cited in Oyovwi, 2012) are of the view that in secondary schools, science is taught through two main avenues. Basic science in the junior secondary school and separately as Physics Biology and Chemistry in the senior secondary school. He further asserted that it is worrisome when research works and conclusions point to the direction of students poor performances in science.

Biology generally is the science of life in animal and plants (Hornby, 2006). It has to do with the studies of the interrelationship between living organism and their immediate environment. In all spheres of human activity, Biology plays a prominent role. It is indispensable in the field of medicine, agriculture and petro-chemical industries. Because of its importance and indispensability, much emphasis has been placed on Biology as a subject and it's instruction at the secondary school level.

"Revised Biology curriculum for secondary school was derived from a draft by the Comparative Education Study and Adaptation Centre (CESAC)", University of Lagos. It is based on a project experimented on for many years in a number of secondary schools located in different parts of the federation.

The objectives of the Biology syllabus for secondary schools were derived from the National Policy on education (2013) and the cardinal objectives of the syllabus are to prepare pupil to acquire:

i. Adequate laboratory and field skills in Biology

ii. Meaningful and relevant knowledge in Biology.

iii. Reasonable and functional scientific attitude

iv. Ability to apply scientific knowledge to everyday life in matters of

personal and community health and agriculture.

In accordance with the above stated objectives, the content and context of the Biology syllabus for secondary school was intended to provide modern Biology courses, as well as meet the needs of the society through relevance and functionality on its content, methods, process and

application (Umoke & Nwakor, 2014). To ensure full actualization and utilization of these objectives in the curriculum, the content and context of the syllabus placed great emphasis on field studies, guided discovery, laboratory techniques and skills coupled with conceptual thinking.

Biology, not until 2013, was a core subject in secondary schools across the nation and a preparatory ground for human development, where career abilities are groomed and potentials and talents discovered and energized (Gambari; Yaki; Gana & Ughovwa 2014), is now an optional subject with Animal Husbandry. A cursory look at the Statistics for Entries and Results, West Africa Secondary School Council Examination (WASSCE) result reports for the years of 2002 - 2013, show evidence of students' low performance in Biology (see appendix I: page 119). This situation is highly unacceptable when we tend to realize that the success of our nation's science and technology depends to a great extent on the mastery of key aspects of science.

Okoye (2014) asserted that the results of senior secondary school students in the Senior Secondary Schools Certificate Examination (SSCE) in Biology, showed very poor performance in the examination. Statistics from the West Africa Examination Council (WAEC) results for 2010, 2011, 2012, 2013, showed that students failed to obtain grade at credit level. Not deviating from the above statistical blue print, Abimbola (2013) asserted that the achievement rate of the senior secondary school certificate students showed significantly poor results for the past twenty years running in the externally conducted WASSCE/SSCE, never rising above 50%.

Okafor and Okeke (2006), not deviating from this view point, also expressed the same low achievement Biology students in West African Secondary Schools Certificate Examination (WASSCE) and NECO, but attributed their stand on these low achievement to the ineffective

teaching methods and strategies employed in teaching of the subject as it is being over dominated by disseminating of facts and concepts (lecture) at the detriment of practically guided work. A detailed analysis of Senior Secondary Schools Certificate Examination (WAEC) result from the statistics unit, shows student enrolment and their performances in Biology and clearly makes lucid the situation on ground which is very unacceptable and discouraging. (Ogundiwin, Edegoke & Asaju, 2014). (see Appendix I: page 119)

This problem of over whelming constant low performance in Biology in externally organized and conducted certificate examinations, according to Nwagbo, (2009) is attributable to certain factors among which are, incompetent mode of teachers' instructional delivery of Biology lesson. Gambari et al (2014) citing the works of Ahmed and Abimbola (2011), Kareem (2005) and Umar (2011), asserted that poor instructional method adopted by teachers was one major factor responsible for poor performance of the students in Biology. To them, most teachers are in the habit of using Lecture Method and sometimes rote learning, in which case the student solely depend on memorization of concepts rather than a complete comprehension of the subject content and concepts.

The Lecture Method has been a major instructional method for teaching in school. Ajaja and Ochonogor (2005), are of the opinion that the Lecture Method has been the primary instructional method of transmitting knowledge and information to students for many years running and has gained wide popularity. Lecture Method as a teaching strategy is predominantly characterized by listening, copying of notes and memorizing of concept. (Inomiesa & Unuero, 2003; Ukpene, 2004).

Similar to the expository teaching, Lecture Method is highly characterized by a teacher transmitting their knowledge to their students. This dissemination of knowledge and information to students, strongly implies that students' learning is largely passive and with the conception that the students' mind is a tabular rasa (a blank slate) on which information, knowledge and concept can be written. With the perceived advantages conceived such as students and teachers covering more content materials within a short period and the fact that students can easily acquire knowledge and new information first hand, there seems to be very little student activity in the teaching process (Ajaja, 2009; Borich, 2004; Bennett, 2003). This leads to the search and development of other teaching strategies that are more result-oriented, student centered and innovative since the Lecture Method has been proven inadequate in the teaching of Biology.

A proper instructional method should constitute how the subject should be taught effectively at the secondary school level (Arisi, 2004). Teaching is only effective when the process used brings about a desirable change in the behaviour of the learner. Teaching should not only stimulate students interest in the subject but also enhance their achievement in examinations. To achieve this paramount goal, there is need for the use of innovative and result-oriented methods. Pellegrino, Chudowsky and Glaser (2001) made complementary recommendations on instructional methods as follows.

- Instructional methods should be organized around meaningful problems and goals.
- They should provide scaffolds for solving meaningful problems and support learning for understanding.
- They must provide opportunities for practice with feedback, revision and reflections.
- They must promote collaboration and expertise as well as independent use for learning.

However, few researchers have systematically explored how these methods influence student's learning. It is pertinent to also understand that the use of a good instructional strategy or method can be unproductive in the hands of an ill prepared teacher. On the contrary, a well prepared teacher has the superlative advantage to find his bearing even when the other conditions are not as good as they should. Nworgu (2013). Therefore, the method a teacher uses for instruction has the potentials of promoting or hindering the learning process.

Okoye (2007), asserted that teaching facilitates learning, but only if the objectives of any given curriculum can be achieved. No matter how rich and good a curriculum is, it's goals and objectives can only be attained if the teachers involved in the implementation have acquired special abilities, (Mari, 2008). Thus Mari stated the following:

- Ability to facilitate learning through effective communication that involves exciting students' and closely monitoring them to be able to introduce attention capturing devises whenever the need arises.
- A good mastery of the school subject to be taught and good use of effective instructional methods that ensure students do not only learn science concepts but are able to apply such concepts to tackle problems of scientific interest.
- Ability to design academic activities that can be successfully carried out by use of local materials and instructional equipment created or invented by the teachers.
- Ability to design and direct result-oriented activities that provide student ample opportunities to make observation, formulate hypotheses, collect and interpret data and provide logical explanation to observed phenomena.

Instructional methods abound to be used by teachers for instruction include methods like Demonstration, Laboratory work, Simulation, concept mapping, Constructivist learning, Problem

based method. Inquiry method, Practice drill, Jigsaw cooperative learning, Small Group teaching and Peer Tutoring strategy, and are all perceived good and effective methods that can be used for instruction in Biology.

Research works have been carried out with attempts to investigate the effectiveness of teaching strategies and methods on achievements in Biology. Results from such investigation conclude that innovative, result-oriented and collaborative approaches such as concept mapping, inquiry, cooperative, Peer Tutoring and Small Group teaching were more effective than the traditional Lecture Method in enhancing students' cognitive achievement in Biology Nwagbo 2010, (as cited in Oyovwi 2012).

Research works in Nigeria, evidently have shown that very little research efforts have been carried out on Small Group teaching and peer tutoring. These approaches have place in the teaching of science and (Biology) at all levels as stated by the Federal Republic of Nigeria (2010) in the National Policy on Education.

Small Group teaching is the dominant genre in instructional process. It is used to refer to instructional delivery in small groups of students in the range of 7-8 at regular meeting, under the guidance of a teacher or by a teacher. Often the students' will have been expected to do some preparatory work prior to the class lesson. The purpose itself will be to develop students' abilities to formulate and debate arguments and to redefine their critical understanding of a particular topic and contents. Gibson (2010). Students in small groups will find out new information about the content in the subject from the teacher, their peers and from materials distributed in class sessions. They will explore and develop their own idea about the materials in discussion and in doing so they will respond to feedbacks from their small group peers and teachers.

Small group teaching has the major advantage for students receiving individualized attention that might not be possible in large class settings and helps teachers to better observe understand how individual student perform tasks and interact with their peers. The Small group teaching is a form of cooperative teaching, and has be compared to the traditional Chalk and Talk Method in much research work and found to be superior (Herreid, 1998).

Small group teaching is similar to cooperative learning in the sense of collaborative and student-centered in most aspects but different in the active facilitating role of the teachers in ensuring supervision and constant feedback. Teaching in Small group enable the students retain information and become more articulate in expressing their thought, thus ending up appreciating different viewpoints better. Herreid (1998), is of the view that Small group teaching enhances student's ability to work in teams. Research works have shown that Small Group teaching helps reduce large size classrooms into smaller manageable and accessible groups. In line with this assertion, Yaro (2010) in his study on class size and academic achievement of students in mathematics in south-western Nigeria found out that the academic achievement of students in large classes was low (23%) as compared to students in smaller classes (64%). Cruickshank, (2003) described Small group teaching strategy as a cooperative and collaborative strategy where students collaborate together to learn in Small group and are rewarded for their collective accomplishments.

Peer tutoring can simply be put as student being instructed by another student. The student who instructs is called the tutor, while the student who receives instruction is called the tutee. Peer tutoring is characterized by specific role taking. In Peer tutoring, the brighter or fast learners are made to teach (tutor) the less bright or slow learner on a particular biological concept or topic (Azubike, 2012). Peer tutoring helps for small group, intense focused instruction which

avails students the opportunity for active interaction among themselves and thus learn from their peers in the process. (Abrami, Poulsea and Chambers, 2004; Topping, 2005; Horvath, 2011).

Allen (2011) asserted that Peer tutoring is one student teaching another in a school setting and may occur in different forms. In whatever way it occurs, Peer tutoring, through research finding, has been seen to promote student engagement and highly linked to academic achievement. Hattie (2009). Topping 2005, (as cited in Mcgennis 2012), asserted that participants in Peer Tutoring receive specific or generic training.

Tiwari (2014) is strongly of the view that Peer Tutoring has been found to be effective in the improvement of academic achievement for a wide range of learners irrespective of the diversity that exist and is used across most academic subjects.

Similarly, Small Group and Peer Tutoring strategies share some fundamental features. They both employ small teams of students to promote peer interaction and cooperation for studying academic subjects. Evidently, these groups become the social unit in which learning is achieved. Clearly Small Group teaching and Peer Tutoring strategies require some changes in the classroom arrangement and instructional process. Research works have shown increased response opportunities, provision of additional time for positive feedbacks and increased time-on-task for students (Meheady, 2011).

Tiwari 2014, (as cited in Cohen, Kulik & Kulik 1982), Cooke, Heron and Herrard (1985), and Johnson and Johnson (1991), believed that regardless of the achievement, classroom management and content area, Small Group and Peer Tutoring strategies help demonstrate effectiveness in facilitating progress in academic tasks.

Chinanson, Kurumeh and Obida (2010) elaborating on the works of Kundo and Tutoo (2002) explained that student retention is the preservative factor of the mind. They asserted that

"the mind acquires materials of knowledge and information through sensation and perception. When a stimulating situation occurs, retained images are revived or reproduced to make memorization possible. In this light, when using Biology concepts there is need for concepts to be presented to the students in ways that awaken their sub-conscious which can trigger quick recalling of the concepts being learned or taught. Small group teaching and Peer tutoring strategies are effective instructional methods that can serve this purpose of actually making both fast and slow learners understand and retain Biology concepts through their collaborative and active learning process. Retention is measured in collaboration with achievements. Kurumeh, Onoh & Mohammed (2012), Hornby (2002) asserted the retention is the ability of students to remember experiences and things learnt.

The secondary school is where the foundation for sound science education is laid and science subjects, but unfortunately, Chukwu (2011) is of the view that students' retention in sciences has remained very poor in the past decade. Chukwu believes this poor retention abilities of students in the science is affecting their academic performances in externally conducted certificate examinations (Mbajirogu 2002; Ogba (2005).

This study is a reflection on the development and implementation of instructional strategies to assist students in their learning process and help motivate them to be committed to high performance or achievement in Biology, active learning in science and progress. Both Small Group teaching and Peer tutoring are based on ideas that meaningful learning occurs when new knowledge is consciously, explicitly and deliberately linked with relevant concepts which the learner already knows. The goal therefore is to support the learning process by the introduction of supplementary instructional strategies and raise the level of achievement, motivation and retention in academic tasks in Biology. This suggests that the more the student are involved in

activities in the instructional process, the better their acquisition of knowledge, development of relevant skills and thus the likelihood of greater achievement and retention in Biology. Research works by Kirkham and Ringlestein (2008) conclude that students' involvement in the instructional process does significantly have a motivating influence on achievement.

The actual state of sex difference in various fields of human endeavour remains a key issue of many research works. Solomon (2004) in his study of sex differences and students achievement in secondary school Biology concluded that boys performed better than girls. Sex (sex difference) is a moderating variable of this study and much work has been carried out on this variable. Sex difference has been found to have influence on students' perception of the subject matter. Many researchers have observed from their various research works that boys tend to do better that girls in science subjects generally and thus they concluded by the perceived reason that girls had or showed lukewarm attitudes to science which affects their perception and performance.

Statement of the Problem

The persistent poor performance of secondary school students in externally conducted certificate examinations organized by both the West Africa Examination Council (WAEC) and National Examination Council (NECO), leaves one in doubt about the effectiveness of the teaching methods used by the Biology teachers for teaching the subjects. Certain factors have been attributed to this problem. Factors like lack of science equipments, inadequate qualified Biology teachers, overcrowded classes, poor instructional and infrastructural facilities and the use of in-appropriate teaching methods employed by the Biology teachers have been identified by many researchers.

Although some researchers and science educators advocate the use of more innovative, result-oriented, and student-centred strategies like cooperative learning, concept mapping, inquiry, Small group teaching, Peer tutoring and programmed instruction, there are evidences that reveal that the prevailing teaching methods still being used in secondary school Biology teaching is the Lecture Method. This method makes these science students passive and bored in the process of instruction.

If the teaching strategies used in the instructional delivery and students' achievement is to improve, then there has to be the urgent need for the introduction of more innovative, effective and appropriate teaching methods for the teaching of Biology in secondary school in Nigeria. Evidence from research works in Nigeria indicate that very little research effort had been directed at the use of Small group teaching and Peer tutoring strategies in teaching Biology. This use of Small group teaching strategy and Peer tutoring by the Biology teacher may increase meaningful and constructive learning of Biology. The problem which this study seeks to solve therefore is will Small group teaching and Peer tutoring strategies improve student's academic achievement and retention in Biology?

Research Questions

The following research questions were raised to guide the study:

1. What is the difference in the mean achievement test score of Biology students exposed to Small group teaching strategy, Peer tutoring strategy and Lecture Method?
2. What is the difference in the mean achievement test score of male Biology students exposed to Small group teaching strategy, Peer tutoring strategy and Lecture Method?
3. What is the difference in the mean achievement test score of female Biology students exposed to Small Group teaching strategy, Peer tutoring strategy and Lecture Method?

4. What is the difference in the mean achievement test score of male and female Biology students exposed to Small Group teaching strategy?
5. What is the difference in the mean achievement test score of male and female Biology students exposed to Peer Tutoring teaching strategy?
6. What is the interaction between the teaching strategies and Sex on student achievement in Biology?
7. What is the difference in the mean retention score of Biology students exposed to Small Group teaching strategy, Peer Tutoring strategy and Lecture Method?
8. What is the difference in the mean retention score of male Biology students exposed to Small Group teaching strategy, Peer Tutoring strategy and Lecture Method?
9. What is the difference in the mean retention score of female Biology students exposed to Small Group teaching strategy, Peer Tutoring strategy and Lecture Method?
10. What is the difference in the mean retention Score of male and female Biology students exposed to Small Group teaching strategies?
11. What is the difference in the mean retention Score of male and female Biology students exposed to Peer Tutoring strategy?
12. What is the interaction between the teaching strategies and sex on student retention in Biology?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

Ho_1 There is no significant difference in the mean achievement test score of Biology students exposed to Small group teaching strategy, Peer tutoring strategy and Lecture Method.

Ho_2 There is no significant difference in the mean achievement test Score of male Biology student exposed to Small group teaching strategy, Peer tutoring strategy and Lecture Method.

Ho_3 There is no significant difference in the mean achievement test Score of female Biology students exposed to Small group teaching strategy, Peer tutoring strategy and Lecture Method.

Ho_4 There is no significant difference in the mean achievement test Score of male and female Biology student exposed to Small group teaching strategy.

Ho_5 There is no significant difference in the mean achievement test score of male and Biology students exposed to Peer tutoring strategy.

Ho_6 There is no interaction between the teaching strategies and sex on student's achievement in Biology.

Ho_7 There is no significant difference in the mean retention test score of Biology students exposed to Small group teaching strategy, Peer tutoring strategy and Lecture Method.

Ho_8 There is no significant difference in the mean retention test Score of male Biology student exposed to Small group teaching strategy, Peer tutoring strategy and Lecture Method.

Ho_9 There is no significant difference in the mean retention test Score of female Biology student exposed to Small group teaching strategy, Peer Tutoring strategy and Lecture Method

Ho_{10} There is no significant difference in the mean retention test Score of male and female Biology students exposed to Small Group teaching strategy.

Ho_{11} There will be no significant difference in the mean retention test Score of male and female Biology students exposed to Peer Tutoring strategy.

Ho_{12} There is no significant interaction between the teaching strategies and sex on student retention in Biology.

Purpose of the Study

The major purpose of this study is to determine the effect of Small Group teaching and Peer Tutoring strategies on student achievement and retention in secondary school Biology. Specifically, the studying will.

- Find out if there is any difference in the mean achievement test score of Biology students exposed to Small Group teaching strategy, Peer Tutoring strategy and Lecture Method.
- Find out if there is any difference in the mean achievement test score of male Biology students exposed to Small Group teaching strategy, Peer Tutoring strategy and Lecture Method.
- Find out if there is any difference in the mean achievement test score of female Biology students exposed to Small Group teaching strategy, Peer Tutoring strategy and Lecture Method.
- Determine if there is any difference in the mean achievement test score of male and female Biology students exposed to Small Group teaching strategy.
- Find out if there is any difference in the mean achievement test score of male and female Biology students exposed to Peer Tutoring teaching strategy.

- Determine if there is any interaction between the teaching strategies and Sex on student achievement in Biology.
- Find out if there is any difference in the mean retention score of Biology students exposed to Small Group teaching strategy, Peer Tutoring strategy and Lecture Method.
- Find out if there is any difference in the mean retention score of male Biology students exposed to Small Group teaching strategy, Peer Tutoring strategy and Lecture Method.
- Find out if there is any difference in the mean retention score of female Biology students exposed to Small Group teaching strategy, Peer Tutoring strategy and Lecture Method.
- Determine if there is any difference in the mean retention Score of male and female Biology students exposed to Peer Tutoring strategy.
- Find out if there is any difference in the mean retention Score of male and female Biology students exposed to Peer Tutoring strategy.
- Determine if there is any interaction between the teaching strategies and sex on student retention in Biology.

Significance of the Study

This study will be carried out with a view to providing information about the effect of Small Group and Peer Tutoring teaching strategies on student achievement and retention in secondary school Biology. This research work will be of immense significance to:

- Curriculum planners,
- Biology teachers
- Biology students
- Educational professionals and administrators
- Researchers

To curriculum planners, findings from this study will make it a necessity to intensify the aspects of instructional strategies in planning and curriculum development in instruction of Biology in secondary schools.

The outcome of this research work will also help secondary school Biology teachers to be more innovative on the use of appropriate instructional strategies in teaching Biology. This study will also help equip the Biology teachers with the necessary skills of Small Group teaching and Peer Tutoring strategies in teaching Biology and science subjects.

This study will also be of great importance to educational administrators in the Ministry of education in the aspects of teachers' recruitment. This will help in the employment of professionally trained, innovative and qualified Biology teacher charged with the zeal and motivation to stimulate students' interest in Biology.

This study will also help to expose Biology students to more student-centered and cooperative learning that will ensure perfect working together in units for better achievement in academic tasks.

Finally, this research work will serve as a reference material to future researchers that will help in providing essential instruments, data and empirical findings on Small Group and Peer Tutoring teaching strategies in teaching Biology.

Scope and Delimitation of Study

The scope of this research work covers the areas of Sense organs, Reproduction in animals and Reproduction in plants. This work is designed for all public Senior Secondary School II (SSS II) Biology students in Delta State. The focus of this work is to examine the effects of Small Group and Peer Tutoring teaching strategies on student achievement and retention in secondary school Biology. This study will also compare the achievement and

retention of Biology students that will be exposed to Small Group and Peer Tutoring teaching strategies.

Limitation of the Study

The researcher experienced the following limitation in the course of this study

1. The experimental group 2 (peer tutoring) has a small size. It is true that this small size could have affected the result of this study.
2. Time constraint in the training of peer tutors in experimental group 2 and briefing of the research assistants.
3. Lack of dedication on the part of peer tutors and tutees in the experimental group 2 (peer tutoring).

Operational Definition of Terms

The following concepts and terminologies are hereby operationally defined as used in the study:

Peer Tutoring: A process where a Biology student (tutor(s) teaches another student(s) tutees(s).

Small Group Teaching: Implies the process of dividing the Biology class into Small Group of 7-8 students' and assigning them academic tasks, choosing one student as a group leader through the process. The Biology instructor is seen as a facilitator, monitoring and guiding the whole process of learning, ensuring feedback always at intervals.

Student Achievement: it is the score achieved in a Biology test when exposed to Small Group and Peer Tutoring strategies.

Student Retention: Implies to knowledge of the concept or what is left on the cognitive structure of a leaner after a period of time at leaning of a given material.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviewed relevant related literature to the study. The literature review was carried out along the following sub-heading:

- Theoretical framework of the Study
- Concept of Small Group Teaching Strategy in Biology
- Small Group Teaching Strategy and Tips for Inclusive Teaching of Biology
- Structuring of Small Group Task, Size and Composition
- Concept of Peer Tutoring strategy in Biology
- Types of Peer Tutoring Strategy
- Organizational Dimensions in Peer Tutoring strategy
- Student Academic Achievement in Biology
- Concept of Student Retention
- Strategies of Students Retention in Small Group and Peer Tutoring in Biology
- Effective Classroom Management for Achievement and Retention in Small Group and Peer Tutoring Strategies in Biology
- Benefits for students' Achievement and Retention in Tutors and Tutee.
- Empirical Studies on Small Group Strategy
- Empirical Studies on Peer Tutoring Strategy
- Appraisal of Literature Reviewed

Theoretical Framework of the Study

This research work anchored on the theory of Vygotsky (1978) on cognitive co-constructivism. His work tilts towards Small groups and Peer tutoring, cognitive constructivism learning experience and suits this study. Vygotsky (1978) argued that it is not only information that is internalized, but also fundamental cognitive processes that are implicit in the communication. The aspects of learning in the child's development appear twice. First on the social level and the next on the individual level: Vygotsky postulated that problem solving in collaborative spectrum is more capable of bringing peers into a new reaction of potentials. These new areas, he called the leading edge of children's intellectual growth, a zone of proximal development (ZPD).

A theoretical ground for Peer Tutoring can be found in Vygotsky's idea of the Zone of proximal Development. This theory holds that peers co-construct new meanings and cognitive structures from learning experiences. Topping and Ehly (1998) asserted that inter-subjectivity which in this context of Small group and Peer tutoring can be thought of as the length to which two, three or four individuals or more can engage in conversation that transcend their world which is a function of cognition. According to Vygotsky, peer interaction in learning is vital in allowing internalized, long term cognitive development. This ZPD is created when a child interacts with more experienced mentor in intellectually productive ways.

Accordingly, both parties in the interaction stand to benefit. The tutee(s) profit from the very acts of questioning, challenging and providing feedbacks to the tutor(s). The tutor also profits from the act of reformulating knowledge for forwarding or onward transmission to the tutee. (Mehra & Rathee 2004). They believed that answering the tutees questions and

responding to the tutees is challenging. Damon (1995) was right to say in the old axiom that one never really knows a subject until one tries to teach it.

Vygosky considered Direct Instruction as the best way of teaching and learning, where a more competent peer or teacher assist student in learning and development by providing "Scaffolding" in the Zone of Proximal Development (ZPD). According to Vygosky, in this context, Scaffolding means assisting the less competent learner by telling, asking, hinting, showing, getting attention encouraging and reminding learners (Razia 2012).

This theory clearly suits the Peer tutoring strategy in increasing the student academic achievement and retention in Biology and could be related in many aspects to the Small group strategy in which case, though through lecturing by an effective teacher has the collaborative team work of groups and the students in their Small Group work together for a common goal and are rewarded collectively. Vygotsky (1987), believed that student's learning actually occurs within the ZPD. This zone consist of a range of tasks too difficult for the child to perform alone but possible to accomplish with the help of a teacher or a more skilled peer. Shapiro and Levine (1999), asserted that educational outcomes are related with student engagement, thus, small group and Peer tutoring strategies which makes the student more actively involved, can influence to a large extent their academic achievement and retention in secondary school Biology.

Facts and principles underlying the vygotsky theory on the theoretical framework of this study

- Vygotsky asserted that children's best learning takes place within their Zone of Proximal Development (ZPD).
- Vygotsky was of the view that the learning environment for children should involve guided interactions and they should change their conceptions through social interaction, speech and communication.
- Vygotsky's postulations asserted that a range of task too difficult for the child to carry out alone can be done with the help of a more skilled adult (teacher) and or a more skilled peer (tutor)
- Vygotsky's theory adheres to the significance of dialogue amongst peers (Peer Tutoring or small group) as an avenue by which individual negotiate conceptual change.
- Vygotsky "the Zone of Proximal Development is the difference between the actual development level as determined by individual problem solving and the level of potential development as determined through solving problems under adult guidance in small groups or collaboration with more knowledgeable peers (peer tutoring). The result of this process is that the child becomes more socialized in the dormant culture and induces cognitive development (Moll, 1994)

Conclusively, Vygotsky's theory anchors on the fact that the ideas of social interaction through scaffolding by peers and more skilled adults with each learner's Zone of Proximal Development. This is inherent in Peer Tutoring and Small Group teaching strategies.

Concept of Small Group Teaching Strategy in Biology

Small Group teaching strategy is a form of co-operative learning which has been compared to the traditional Lecture Method over the years and found in many studies to be superior to the "talk and chalk" Lecture Method, Herried (1998). Small Group teaching provides opportunities for hands-on activities for students that results in products in which students' perform mental operations. It implies that students sit in chatter form or groups in small groups where they can learn and help each other, (Imo, Uwandu & Ekanem 2012). To them, the limited instructional materials which could not go round students in a large class size, can be shared by the students in Small Group settings. In Small Group teaching which is usually characterized by re-arrangement of the class through grouping, entails students being shared into groups of 6-7 members. When sharing the class into groups, the teacher always ensures each group consist of mixed ability and equal ratio of male and female participants. This is in line with Okebukola (1984), when he suggested that in structuring group instruction, intra-group co-operation is a profitable way of tackling the problem of large class size.

Teaching in small groups provides opportunities for students to be more interactive than in setting such as large groups. Generally the intention of Small group teaching is to discuss problems about the subject matter and clarifying their own understanding through comparing and contrasting their own views with those of their teacher and peers.

In Small Group teaching expectations and intentions could differ widely between student and teacher, and the successful interaction in these small groups in challenging and sometimes different. It is very important for teachers in Small group settings to monitor participation

patterns and be aware of learning barriers. It is important to look for opportunities and engage with the diverse ability levels of the student and their experience represented in the class.

One concern in Small group is that some students are reluctant to participate or speak. There are many reasons and causes of students' hesitance to contribute, participate or speak in class interaction. It takes one who has experienced similar situation to understand such conditions and empathize. In some cases, students might not comprehend the need to initiate interactions, or may feel uncomfortable doing so because they lack confidence in expressing themselves using simple correct English and would not want to be mocked by their peers. The short comings associated with Small group instructional mode are numerous and can only be implemented successfully when carefully planned sequentially using the proper strategies and tips since these initial difficulties experienced in Small Group settings can have a cumulative impact.

Small Group teaching and learning according to Imo et al (2012), citing the works of Johnson and Johnson (1987), asserted that the class is divided into small groups depending on the class size and nature of the academic task at hand. A group is viewed as a collection of individuals working together as a team for successful completion of a task or assignment. The wide scheme of work, variation in school environment and a large number of students in the class necessitates a degree of teacher expertise in methods of presentation of subject matter to the students. Imo et al (2012), are of the view that one of the ways in which teaching of Biology in secondary schools can be improved is to adopt the method of using Small group teaching approaches in their respective classroom to enhance students academic performance in the subject.

Small Group Strategies and Tips for Inclusive Teaching of Biology

The basis for the Small Group teaching strategy is that the students will be actively involved in the learning process and as the students are in free atmosphere, they are likely to learn effectively through the help of themselves rather than when the teacher doing all the teaching. Imo, et al (2012), are of the view that when the presence and participation of all are needed for the realization of a common goal, group involvement can be developed through the use of Small group. Despite all of these positive contributions, Small group teaching needs proper planning with strategies and tips to be adhered to by the teacher whose rate of teaching is more demanding here to achieve immense success in the process. Success can only be achieved in Small Group teaching strategy when properly planned.

A study at Finders University on teaching and learning proposed some strategies and tips inclusive for Small Group teaching, which emphasized advanced preparation to ensure that the content and materials are inclusive and that expectation are articulated and clarified. These strategies and tips advocate the use of inclusive teaching and learning and activities that can help breakdown or overcome the barriers to effective participation and provision of effective feedbacks. These tips are designed to assist all students to:

- Feel more comfortable about participating and contributing.
- Avoid “talking off their heads” and instead use evidence to support their views (teacher).
- Prevent the talkers from taking over (teacher).

Tips in Small Group Strategy

- Find out about your student, educational origin and experiences to provide information to support your planning.
- Provide materials to help students prepare before classes.

1. A list of terms and concepts that are central to the topic to be taught.
2. Guiding questions on the topic to be discussed in their various groups.

- Plan alternative or supplementary activities for student who might have difficulty with any of the core activities.
- Establish a culture of questioning.

It is reasonable in a learning context for the students not to know the answers.

The aim is not for you as the teacher to provide the answers, but for all students to add what they know to construct correct answers.

- Setting up brainstorming groups

i. Instruct students to go into their small groups and brainstorm on the concepts and topic to be learned in that particular session or class.

- Ensure inclusive discussions.

i. Instruct students to write or pre-prepare a question from the previous class for the whole group to discuss.
ii. Provide students with a chance to prepare contributions before presenting to the group.
iii. Give student thinking space to ease the pressure.
iv. Instruct students to share in pairs.
v. Provide pair/sub-groups with materials to make notes on them and share the conclusion of their discussion.

vi. Use buzz groups (Small sub-groups, formed for just a few minutes) so that students, can discuss issues and answer questions before reporting back to the group just like jigsaw cooperative learning.

vii. Provided time for students to review their presentation with others in the class before the group discussion.

- Structure activities so that no one becomes invisible.

  Assign a range of roles and responsibilities for group, where students are encouraged to experience different roles over time.

  Possible group roles could include:

Leader Recorder – (To make notes on discussion)

Observer – (To ensure everyone gets a voice and their own view point)

Counter-arguer - (To ensure alternative views are canvassed)

Summarizers – (To present the groups conclusion to the group)

Reporters - (To present the groups conclusion to the class).

Structuring of Small Group Task, Group Size and Group Composition

The structure of the task is what separates just any group activity from a cooperate learning activity. Group discussion hardly allows for division of labour, role responsibilities, collaborative efforts and end products that promote critical thinking evident in Small Group or co-operative learning activity, (Borich 2003). Borich, put forward some factors to be considered when structuring a Small group (Co-operative learning task as follows.

- How large should the group be?
- How will the group members be selected?
- How much time will be devoted to group work?
- What incentives or rewards will be provided for individual and group work?

Group Size: The question that arises here is how many students should be in the group? Group size is one of the most important decision to be taken in this kind of Small group technique. Small group strategy though depends or is influenced by the size of the original class, the number of individual learners assigned to groups has far reaching consequences based on the following.

- The range of abilities within a group.
- The time required for a group to reach consensus.
- The efficient sharing of materials within a group.
- The time needed to complete their task.

All these factors will be changed by the number of members assigned to the group, then it is advocated to arrange group sizes approximately equal.

According to Cohen (1994), Johnson, Johnson and Holubec (1994) the most appropriate group size for efficient completion of task or an academic goal in the least time is 4-6 members. This in a class of 40-50 student, typical of the Nigeria educational setting, about six or seven group should be formed. Thus the rule of thumb is to compose groups of 6 – 7 members for a single period activities and slightly larger groups when the activity extends over more than a class period, requiring greater task complexity and role specialization.

Group Composition: The selection of group members in the Small group teaching strategy is another very important duty of the teacher. Unless the task specifically requires specialized abilities, it is only proper to form heterogeneous groups with a representation sample of all learners in a class. Hence, assigning a group of a mix of high and low ability, more verbal and less verbal, and more task oriented and less task oriented learners is most appropriate in constituting a group composition. This diversity usually contributes to the collaborative process by creating a natural flow of knowledge from those who have it to those who need it.

Johnson, Johnson and Holubec (1994) and Johnson and Johnson, (1991) in Borish (2003) suggest additional procedures for forming Small Groups as follows.

1. Identity isolated student who are not chosen by any other classmate, then build a group of skillful and supportive students around each isolated learner.
2. Build constructive relationships between majority and minority students, between learners with and without disability. And between boys and girls, use heterogenous serious group with students from each categories.
3. Share with student, the process of choosing group members. First, you selects a member for a group, than that member selects another and so on, alternating between your choice and student's choice until the group is complete.

Benefits of Small Group Teaching

Jaques (2004) while citing the benefits of teaching in Small group argued that the purposed and benefits of group learning closely coincides with the goals of higher education in general. Jaques (2004) put forward the following benefits of Small group teaching as thus:

- Providing students the opportunity for more active involvement;

- Allowing students to discover and engage with a range of perspectives, ideas and backgrounds;
- Assisting students to clarify their attitudes and idea about the subject matter, as they test their own ideas and attitudes against those of others;
- Helping students to develop a sense of academic rigor and a willingness to share idea;
- Providing opportunities for students to receive more immediate feedback on their learning;
- Encouraging students towards self-directed and independent learning
- Providing more opportunities for peer learning and sharing responsibility for learning;
- Providing more opportunities to develop skills in communication (listening, responding and interacting and also personal relations; and
- More easily establishing rapport between the teacher and the student.

Concept of Peer Tutoring in Biology

Peer Tutoring should be viewed as one form of peer collaboration under co-operative learning approaches to instruction. It entails well structured, guided and formalized peer interaction to promote and facilitate academic achievement. (Mickelson; Yetter; Lemberger; Scott & Ayer, 2003). Studies carried out have proven that when properly supervised such approach have been very effective on a variety of students academic achievement (Cohen, 1997). Peer Tutoring is seen as the approach to learning instruction in which one student instructs another student in materials on which the first is an expert and the second is a novice. This definition should not be accepted generally because of its contentious nature since not all peer tutors are experts.

Peer Tutoring teaching strategy is one that promotes actives engagement for all learners in the classroom. It provides all learners the opportunity to excel academically and achieve most

educational goals. In the direct words of Johnsons (1981) cited by Sarah (2009), "education should have educational goals that consist of transferring knowledge and skills, socializing children and adolescents into perspective values and attitudes that they need to function in our society, and facilitating the cognitive, social and physical development of each individual student.

Peer tutoring is characterized by specific role taking in most cases. In Peer tutoring at every point, students have the role of tutor(s) while the others are in the role of tutee(s). Broadly speaking Peer tutoring places high focus on curriculum content guided by specific procedures for interaction. These interactions are usually guided by the provision of structured materials amongst which a degree of student choice may be available. Student's tutors usually undergo training which is either specific or generic or even both. For this reason Schleyer (2005), asserted that much research has shown that students' academic success improves significantly when tutors are trained by trained staffs.

Peer tutoring involves pairing of the students by the teacher based on their ability level. It involves students playing the status of a tutor and a tutee and applying the principles and practices of one who teaches also learns (Walberg & Susan, 2000, cited in Tella 2013). According to Tella (2013), Peer tutoring can be that instructional strategy with a great promise for achieving the complex academic and social needs of students with diverse learning abilities in regular classes without affecting others in the class, believing that when students supplement teachers efforts to help assist low achievers in large class sizes which is typically in the country's educational settings.

Most literatures on Peer tutoring strategy show the program or approach as being effective. According to Chen (2008) while reviewing works carried out by Cohen, Kulik and Kulik (1982), showed that there was a significantly high achievement effects on the tutee and a smaller but significant effect on their attitudes toward the subject matter concerned. Chen (2008) believed peer tutoring, in small groups or one –to – one basis, encourages independent learning and helps develops study skills and greater socialization effect.

Peer tutoring has been found to be successful in promoting the academic and social skills (Nazzal, 2002). Research on Peer tutoring has directed its effectiveness to improving both tutors and tutors academic and social development (Cohen & Kulik, 1982; Sivengal, 1991) Miller, Barbetla (1994), provided a practical guild to the steps involved in carrying out a successful Peer tutoring program. They outlined five steps, from choosing the tutoring format and training the tutor through testing for effectiveness.

1. Select a tutoring format
2. Train the tutors
3. Arrange the environment
4. Run the program
5. Test for effectiveness

Peer tutoring can be structured so that all participant benefit. Peer tutoring can lead to social and academic development. Besides the improved use of instructional time, some positive attributes are increased, such as learning, social growth and friendship among students.

Peer tutoring is such strategy that provides small group, individualized that is intensive, focusing instructions that allow students an opportunity for active responding and immediate

student feedback. In Peer tutoring groups, an instructor or teacher groups students into dyads, matching higher and lower performing students in pairs. (Romano & Walker 2010).

Forms of Peer Tutoring Strategies and Teachers Role

Peer Tutoring instruction in a classroom is seen as students learning from one's peers in small groups characterized by specific role taking as tutors or tutees, which is highly focused on curriculum content but usually without clear cut procedures in the interactions and in which the participants receive specific and or generic training (Topping, 2005, cited in Mcgennis 2012).

According to Allen (2011), Peer tutoring is one student teaching another in a school setting and this occurs in three common forms. Allen, (2011), thus categories them as follows:

- Cross - age tutoring
- Cross - ability tutoring
- Reciprocal tutoring

Cross age tutoring occurs when older student act as tutors to younger students. For instance, SS II students tutoring SS I students, while cross ability tutoring occurs when student with a greater mastery of the subject matter acts as a tutor to a less bright student (tutee).

Dame (2012), believed that cross age and cross ability tutoring are used interchangeably in the research ambit. To him, age and ability are highly correlated variable and cross ability tutoring often suits most studies. Reciprocal tutoring occurs when students of the same age or ability inter switch between tutor and tutees. Dame further asserted that cross age ability research

have proven more effective and advantageous than the reciprocal peer tutoring. Research works by Topping (2005), classified Peer tutoring types into four categories namely:

1. **Class Wide Peer Tutoring:** This occurs when the class is broken down into dyads. Each student participating in reciprocal tutoring by providing prompt, error corrections and helping their partners. Task cards are given to the students to ensure that the objectives of the lesson are adhered and focused upon. This ensures that the class is involved in the process.
2. **Bi-directional Peer Tutoring**: This approach is the same as the reciprocal Peer tutoring in Allen's work. Topping (2005), explained that a child with and a child without a disability form a dyad. Both student taking turns at being a tutor and tutee. The teacher serving his/her facilitator role encourages switching of roles for each skill, week or unit. Topping believed that this approach provides the student each an opportunity to be the teacher.
3. **Unidirectional Peer Tutoring**: According to Topping (2005), here a trained peer tutor carries out the role throughout the program. This research work is hinged on this type of Peer Tutoring strategy.
4. **Cross Age Tutoring:** It occurs when an older student is chosen to tutor a younger student. Topping asserted here that the tutor gains more teaching experience.

This research effort will be more concerned with the views of Falk and Wehby (2001) because it best suits the objectives of the study. This study focuses on Small group peer learning strategy as an instructional strategy. Falk and Wehby, contrary to those of Topping and Allen, listed three general types or forms of peer tutoring:

- Informal learning group
- Formal learning group
- Co-operative based group

1. **Informal Learning Group:** Here groups of students are constituted mainly on temporal bases. The student comes together during an active class. It usually occurs when the teacher asks student to discuss a question with members of the groups and one taking the role of the tutor in the discussion.
2. **Formal Learning Group**: This occurs when a group of student (small) is formed for a particular task. Such as carry out a laboratory experiment teaching themselves in the process. This group of Peers may complete their assignment or project in a single class or even over a specified time frame given by the teacher serves as a facilitator.
3. **Co-Operative Based Group:** This is a collaborative learning in small groups' takes long periods. Students are grouped 4-6 in number and take turns in teaching themselves based on abilities in a particular topic or academic task. The success here depends on the ability of group members to stay on track, share ideas and work together.

McGinnis (2012), citing the work of Topping (2005), asserted that there are no clear cut procedures for Small group Peer tutoring learning strategy, but Tiwari (2014), feels differently when the he proposed tips for designing, developing and implementing Peer Tutoring activities in his work "Peer tutoring: A step forward inclusion".

Tiwari (2014), states the design and development as follows:

i. Planning: Careful planning, monitoring and continuous provision of support to the young tutors. Research evidence advocate good and detailed planning is paramount for the success of the strategy and beneficial to the student while enhancing tutors self esteem and creating a good climate in the class.

ii. Selection of tutors: Careful selection of tutors is the most sensitive aspect of a successful design of Peer Tutoring strategy. Academic performance ability and age are a few criteria for selecting students that fits as tutors. Engaging older and high ability student of a group as tutors and capitalizing on their high cognitive and intellectual maturity on tutoring other less and young achievers in the group. In addition to these qualities, sociability and personality are also good criteria for a tutor.

iii. Designing a detailed tutoring activity: Tiwari, advocates designing activities that will allow peer tutors to actually support their tutees. Select a good tutor that you know can manage the group activity engaging all members actively in the learning process. Preparing instructional materials that will not only assist but also arouse the students' interest to manage the activity. Try to utilize the resource at your disposal and design multidimensional activities that will benefit both young tutors and their tutees

iv. Supervision and support for tutors: Very essential in this strategy is that strategy is ongoing with, constant supervision and support for the tutors. It is unacceptable to leave the young tutors to deal on their own with their peer (tutee). The teacher is advised to use the instructional time among the groups according to the lesson needs and try to guide the tutors on their work.

v. Demonstration of skills or task to be taught: Teacher should display the activity or academic tasks selected for tutor to be taught.

vi. Assess readiness of peer tutor: Design activities that are going to require different levels of involvement by the students. Such activities will allow students tutor to learn as well by engaging themselves in productive work, constantly assessing their skills repeatedly after each training lesson.

vii. Keeping record of each Small group activities: Keeping progress report on activities of each group and the overall progress of the Small group is very essential. In addition, try to record any distinctive characteristics of effectives or ineffective tutoring behavior. This will help you understand better ways that students cooperate together and will provide you input on how to support better Peer tutoring in your class.

viii. Discuss with peer tutors: Always have after and before discussion with the young peer tutors. These activities encourage them on their tasks and remark the importance of their work for their groups. Give them advice on proper behavior in handling their tutees and try to show them verbal examples on how to instruct others. After the lesson, discuss again with your tutors and try to record any positive and negative aspect of the procedures. Finally always motivate your tutors by words of encouragement. This inspires them to continue tutoring activities in the future.

ix. Discuss with tutees: The teacher should talk to the young tutee before and after the lesson as well. Explaining to them that they are going to be assisted by their classmates and ask their opinions on the lesson afterwards, recording their input and try to take them into account.

With all these designing, developing and implementation procedures it is clear that Peer Tutoring allows teachers to accommodate a classroom of diverse learners including students with learning disabilities. This instructional strategy increases response opportunities for students, provides additional time for positive feedbacks, and increase the amount of time a student is on – task (Maheady, 2001).

Organizational Dimensions in Peer Tutoring Strategy

Peer tutoring leaning can occur in varying organizational dimensions. These dimensions according to Azubuike (2012), include the following:

1. **Contact Constellation:** This organizational dimension may occur when a peer in working with a group of tutee, but with varying group sizes of two to thirty or even more. In some cases two or more peers take a group together. Peer tutoring in pairs (dyads) is extensive and there exist less opportunity to participate in pairs.
2. **Institutions (within or between):** Peer Tutoring may occur or take place within the same school or in different institution or schools. For instance when a peer from a higher institution tutors secondary school students in their neighborhood. When the scenario exist, it is seen as between while when a high achieving student tutors a less achieving one, then it is within the institution or school.
3. **Curriculum Content:** The curriculum content which includes knowledge and skill appreciation are to be covered effectively in the subject being tutored in the Peer tutoring strategy.
4. **Year of Study or Class of Study:** The peer tutor and the peer tutee(s) may be from the same or different classes or year of study and/or be the same or different age groups. This study focused on the same year of study or class. (SS II Students).
5. **Ability Level:** There is increasing interest in same ability Peer Tutoring in most educational scenario but many strategies operate on cross ability basis. In same age/year, the tutor might have superior mastery of only a very small portion of the curriculum, or all might be of equal ability but working towards a shared, deeper and correct understanding.

6. **Role of Continuity:** Reciprocal Peer Tutoring or learning can have the advantage of a wider boost to self esteem, in such ways that the tutor also once in a while becomes a tutee and all participants get to be tutors and tutees. This can also increase the novelty of the process. Therefore, roles need not be permanent, especially in same ability Peer Tutoring or learning process. Structured switching of roles at strategic moments is advisable.

7. **Time:** Peer tutoring might be scheduled in regular class contact time, outside of this, or in a combination of both, depending on the extent to which it is substituted or supplementary for regular teaching.

8. **Place:** Peer learning law very considerably in location of operation. In schools tutorials and workshops.

9. **Characteristics of Peer Tutors:** when tutors are those who are more average in ability or even less, both the tutor and tutees will find some challenges in their joint activities. Even when the gain of the tutees might not be so great, the aggregate gain of both combined may be greater.

10. **Characteristics of the Tutees:** The Peer Tutoring may be for all or a targeted subgroups, such as the gifted disabilities, those considered at risk under achievers, failures or drop-outs.

11. **Objectives:** Peer Tutoring projects may target intellectual gains (cognitive), academic achievements, affective and attitudinal gains, social gains, self esteem and concept gains or any combination. Organizational objectives in Peer Tutoring might include reducing drop outs and increasing access, achievement and retention abilities.

12. **Voluntary or Compulsory:** Some Peer Tutoring projects require participation, while others involve peer tutor self select. This can have substantial or marked effects on the quality of what ensues.

13. **Reinforcement:** Some Peer Tutoring projects involve some form of extrinsic reinforcement for the tutors and sometimes also the tutees, while others rely on intrinsic motivation. Beyond simple social praise or gratification, extrinsic rewards can take the form of certification, subject credit or more tangible reinforcement such as money.

Azubuike, (2012) is of the notion that availability of extrinsic reinforcement can have effects on recruitment in voluntary Peer Tutoring projects, which in most cases might be good or bad. Azubuike (2012) referring to Topping, (2005) asserts that in recent years, more emphasis has been upon equal opportunity involvement in Peer Tutoring and engaging all members of the educational community without exception. Azubuike (2012), citing some organizational needs to be considered when planning Peer Tutoring projects from Toppings (2001), asserts the following:

1. Context: There will be problems and opportunities specific to the local context.
2. Objectives: Consider what you hope to achieve and in what domain.
3. Participants: Who will be the helper (tutor), who will be the helped (tutees) and how will you match them? There will also have to be the trainer and quality assurer.
4. Helping Techniques: Will the method used be packaged or newly designed?
5. Contact: How frequently, for how long and where will contact occur?
6. Materials: This will be required and how will they need to be differentiated?
7. Training: This will be needed for staff first, then for the helpers (tutors) and helper (tutees)

8. Process Monitoring: The quality assurance of the process must be considered.
9. Assessment of students': The product and the process should be assessed and considered Consider whether any of this should be self or peer assessment.
10. Evaluation: You need to consider or find out whether it worked.
11. Feedback: This should be provided to all participants, its improve future efforts.

Small Group Peer Tutoring should be viewed as one form of peer collaboration under co-operative learning approaches to instruction. It entails well structured, guided and formalized peer interaction to promote and facilitate academic achievement. (Mickelson, et al 2003). Research have proven that when properly supervised such approach have been very effective on a variety of students academic achievement (Cohen, 1997). Peer Tutoring is seen as the approach to learning instruction in which one student instructs another student in materials on which the first is an expert and the second is a novice. This definition should not be accepted generally because of its contentions native since not all peer tutors are experts. Small group Peer Tutoring learning strategy provides the opportunity to grow academically and achieve most educational goals. In the direct words of Johnson (1981), cited by Sarah (2009), education should have educational goals that consist of transferring knowledge and skills, socializing children and adolescents into perspective values and attitudes that they need to function in our society, and facilitating the cognitive, social and physical development of each individual student.

Peer Tutoring is characterized by specific role taking in most cases at any point a student has the role of tutor while the others are in the role of tutee(s). Proudly speaking Peer Tutoring places high focus on curriculum content guided by specific procedures for interaction. These interactions are usually guided by the provision of structured materials amongst which a degree of student choice may be available. Students tutors are likely to have training which either

specific or generic or even both. For this reason (Schleyer et al, 2005) postulates that research has shown that students academic success improves significantly when tutoring are trained by trained staffs.

Small group's Peer Tutoring evolves pairing of the students by the teacher based on their ability level. It involves students playing the status of a tutor and a tutee and applying the principles and practices of one who teaches also learns (Walberg & Susan, 2000) in Tella (2013). According to Tella (2013), Small Group Peer Tutoring could be that instructional strategy with a great promise for advising the complex academic and social needs of students with diverse learning abilities in regular clans without affecting others in the class, believing that when students supplement teachers efforts to help assist low achievers in large classroom sizes typically in the country's context.

Most literatures on small group, Peer Tutoring teaming strategy show the program or approach on been effective, and the proof to be stronger. According Chen (2008), in the work carried out by Cohen, Kulik and in 1982 should that there was a significantly high achievement effects on the tutee and a smaller but significant effect on their attitudes toward the subject matter concerned. Chen (2008), believes peer tutoring, in small groups or one–to–one basis, encourages independent learning helps develops study skills and greater socialization effect.

Student Achievement Concept in Biology

Achievement can be seen as a result oriented concept that enshrines the extent to which a desired task is achieved. Achievement is a construct which combines cognitive affective and goal directed behaviors (Ames, 1992). It is the level of success attained in some school tasks especially in some scholastic performance. In this sense, academic performance means the

attainable ability to perform school tasks which can be general or specific to a given subject matter. When student achievement is restricted to academic tasks as above it is referred to as academic achievement. Achievement in this retrospect can be viewed as self perception and self evaluation of one's objective academic success. It is generally induces the learning outcomes of pupils. Academic achievement is a key criterion to judge one's total potentials and capabilities thus more pressing for students to have high academic achievements. Academic achievement is students achievement on a standard of measurement such as skills test and analytic thinking test (Horvath (2011).

According to topping (2000), academic achievement is used to ascertain the extent which programme goals are realized. Academic achievement in students can only be ascertained or measured using examination and tests in education.

According to Popham (2005), these tests are one-size-fits-all. Test items are not always aligned with instruction and there seems to be a mismatch between what is taught and what is tested. Whatever form the examination takes be it written, oral or even aptitude test, it should measure the current status of the student with respect to proficiency in a given area of knowledge or skill. (Morgan, 2010).

These tests are of various types but the important construct here is that they are referred to as instrument used to measure students academic abilities. For this study, it is important we only consider achievement tests.

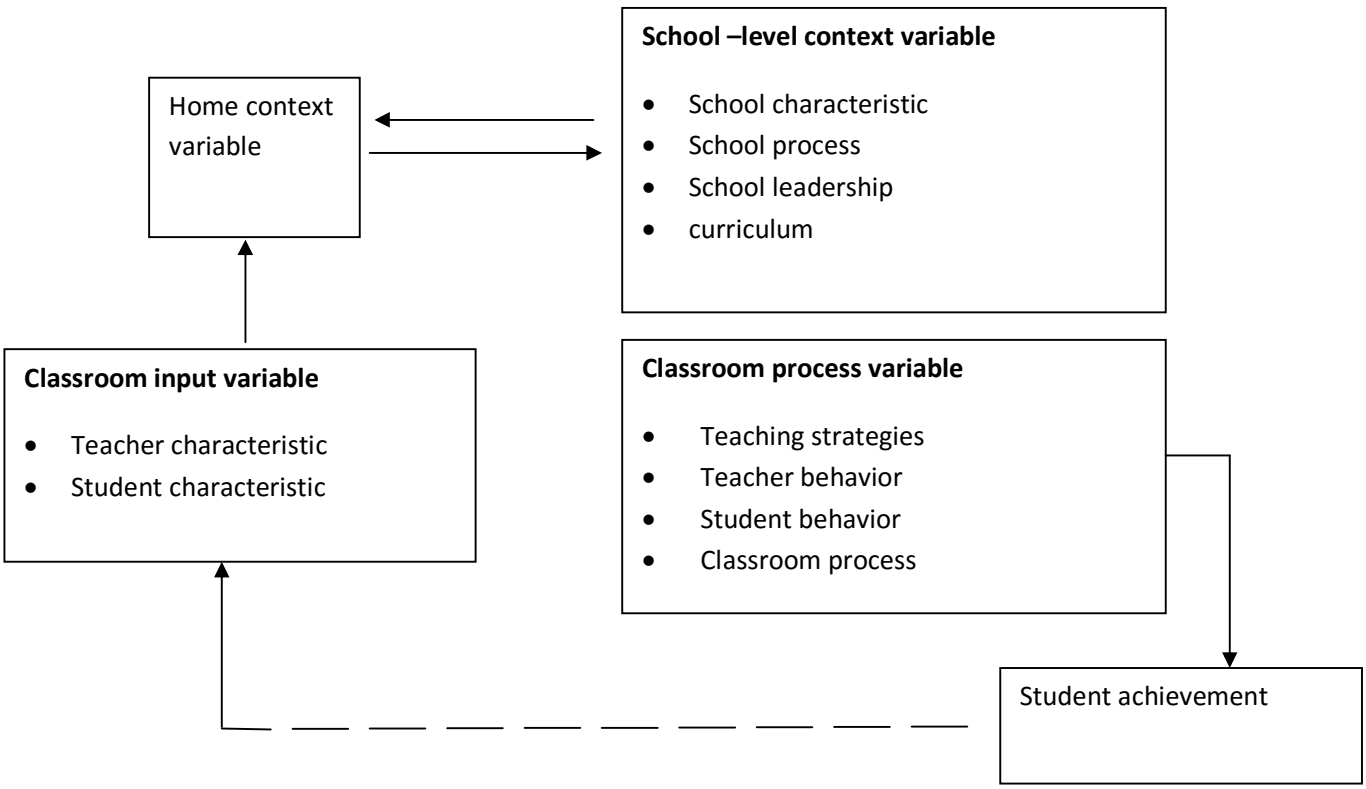
Achievement test are usually the kind of test and examination given in the class. It is aimed at helping or finding out how much learning the learner has acquired or achieved on

mastery of academic content tasks. They are particularly helpful in determine student or group status in academic learning (Azubuike 2012).

Researchers for some time now have identified a number of variables that predict increases in student achievement. (Walberg & Pack, 2000).

Unfortunately, despite these extensive knowledge base about works on student achievement many educationist seem not to utilize their findings effectively. Huitt (2003), developed a framework that can assist in the process of identifying a small number of categories of variable and the relationship among them.

Fig. 1: Categories of Variables Impacting Students Achievement



Source: Huitt (2003),

With regards to Huitts (2003), framework on impacting variables on students academic achievement, there is an assumption on the issue of instructional strategy like the Small Group and Peer Tutoring. Huitt proposes that if one can identify and maximize the single most important variable related to student achievement, then school learning as measured by standardized achievement test will increase, thus increase in students achievement. But (Guastello & Liebovitch, 2009) warned that in a complex dynamical system such as a classroom or school, where variables are related interdependently and non-linearly, the amount of change in a single classroom or school variable can be disproportional to the change in student learning.

This is in line with the fundamental concept of classical mechanical paradigm proposed by Newton, in a linear system that the amount of change in the outcome variable (student achievement) is directly proportional to the change in a context, input or classroom process variable (school size, class size, type of instruction, student - time-on- tasks and teacher efficacy.

Strategies of Students Retention in Small Group and Peer Tutoring

Student retention ability is one aspect that many have neglected in the past. According to Tinto (1997), school teachers, educationist and decision makers seldom place much emphasis on student retention abilities. The result is that student experiences are increasingly segmented into smaller pieces and their academic tasks and relationship with ever their peers at school becomes narrower, thus their learning process is further partitioned into smaller disconnected segments. Teachers, planners and even decisions makers should strive to make enhancing students retention the linchpin about which they organize their activities. They should move beyond the provision of add-on services and establish those educational conditions that promote the retention of all students.

Retention is a preservative factor of the mind. The mind acquires the materials of knowledge through sensation and perception, (Kundo & Tutoo, 2002). These acquired materials in the mind need to be preserved in form of images for knowledge to develop. According to Chianson et al (2010) citing the works of Kundo and Tutoo (2002), assert that wherever a stimulating situation occurs, retained images are revived or reproduced to make memorization possible. Research works on retention have shown that when Small Groups and Peer Tutoring occurs, there seems to always be a form of student collaboration and cooperation. Small Group and Peer Tutoring which are kind of cooperative learning, according to Mekaache (1999), explains that students often elaborate on concept being taught to achieve what is expected. Elaboration provided from one student to another is a win-win situation. It not only enhances the learning of student, who receives the explanation but also deepens the understanding of the student providing the explanations. Chanson et al (2010), thus asserts that consistent elaboration and explanation of a topic would definitely to a large extent bring forth retention of a topic or concepts learnt for a longer period of time.

Retention has two classifications, one is described as retention of knowledge via the process of deep learning (Briggs & Tang, 2007) and the other types of retention in that in a students' study program at the higher education level. The concept of knowledge retention was first addressed by Briggs and Tang in 2006 in their investigation on ht techniques involved in deep learning. Their finding, provides for the postulation by Ramsden (2003), that learners who achieve deep learning as opposed to a shallow learning retain that knowledge past their final examination.

To be serious about students retention, schools about recognize that the root of attraction lie not only in their student and the situation they face but also in the very character of the

educational setting. Vinto (1997), points out for conditions that stand out as supporter for retention abilities of students.

- Expectation
- Advice
- Support
- Involvement
- Learning

Dewinstamely Bjork (2002), Halpern Hakel et al (2003) presented a ten step strategy for improving retentions and retrieval of learning in student.

Ten Strategies for Improving Retention and Retrieval of Learning

The following are ways of improving retention and retrieval of learned materials:

(1) Focus attention

- Introduce lesion with short out line or summary
- Increase curiosity by starting with controversy case or examples ("the hook" or "the lead"
- Use chart, image or video to capture attention

(2) Promote practice at retrieval

- Ask questions periodically to check understanding
- Ask student's why the choice of their answers of the lesson
- Space out quizzes, test for optional long term retention

(3) Require Learners to Present in one Format and Re–percent it in another format

- Providing diagrams or sketches and asking the students to label or fill in the missing links
- Tell learners to rephrase the concept and explain it to each other.
- Tell learners to compare and contrast the concept
- Tell learners to think of the real world application of the concept of phenomenon
- Consider role play scenario to proper understanding.

(4) Change conditions under which learning take place

- Change the format of class time periodically
- Change sitting arrangements from time to time
- Change groups for time to time with different task
- Change tutors from time to time
- Change group leaders from time to time.

(5) Recognize underlying assumptions and prior knowledge and experience.

- Use pre – test
- Ask students' to read ahead and making list of upcoming topics

(6) What students recall soon after learning influences what they learn later.

- Provide self assessment quiz
- Ask different groups to provide a one minute summary of they concept taught
- Ask about key concept from the previous class
- Provide brief summary of key points at the end of every lesson.

(7) Remembering less is more for long term retention and transfer

- Jotting down during lessons
- The strategies enthusiasm on key points

(8) Create "doing" Activities

- Writing exercises
- Chart or diagram to fill in or label
- Demonstration or debates

(9) Integrate materials with prior experience, further control

- Learn what is taught in prerequisite lessons
- Use extreme selected example to make a point.

(10) Promote self – assessment of knowledge

- Study questing
- Other forms of classroom assessment
- Rewards or other form of gratification for success.

The Secondary Schools in where the foundation is laid for sound science and science subjects, but according to Chukwu (2011), unfortunately, the students retention in science subject has remained distressingly poor in the past decode. Chukwu, further asserts that this poor retention abilities in these Secondary School Students, citing literature from Mbajirogu (2002) and Ugbu (2005) in affecting their performances in Science Subjects.

Studies on retention have also for a long time has also been carried out on the place of sex issues. While some findings fill towards the fact males slow greater retention abilities, other thinks differently, placing females an better retainers of knowledge in Science Subjects.

Research reported by a variety of institution points to the positive impact of Small group and Peer tutoring learning on student retention especially the retention in underrepresented and disadvantageous students with under developed basic academic skills (NAS, NRC, 1977)

Effective Classroom Management for Achievement and Retention in Small Group and Peer Tutoring Strategies

Research has shown that effective classroom management allows for better engagement with teaching and learning and higher achievement outcomes as it focuses the class and instructional time on the concept (Lipowsky et al, 2009). Override classrooms which has become a permanent feature of academic setting at the secondary level of the educational system in Nigeria, makes classroom management by teacher an uphill task and Small group, and Peer tutoring help reduce this stigma to its barest minimum takes place when the students listen to the teaching process, conduct laboratory experiments and pay attention to the teachers. Students content engagement usually focuses the student "in – the – moment" cognitive interaction with the content. (Mc Laughlin et al 2005). A well managed classroom and supportive constructional environment can facilitate this engagement process effectively in Small group peer. Tutoring teach (Klieme et al, 2009). Yair (2000), asserts that proper engagement has been conceptualized as the idea that a student mindset is torn between engagement with instruction and distractions that are related to the topics in the class. Therefore, teachers could and should be effective classroom managers in Small group and Peer tutoring learning so as to ensure that rules are clear, taking effective disciplinary actions, building optimal student –student, student-teacher

relationship, and help maintain an alert and objective mindset during instruction (Marzano et al, 2003). The teacher also, as a classroom manager build trust with the student even as a facilitating personnel in the Peer Tutoring process and limit disruptions to the instructional process (Stronge, Ward & Girate, 2011).

According to Morzano et al (2003), effective teachers are able to create an optimal classroom environment by providing a clear purpose and strong guidance for the classroom while encouraging cooperation among the students (tutor(s) and tutee(s)) and an environment of respect between students as well as between student and the teacher. Supportive teacher – student relationships are very necessary not only in fostering achievement, but also to increase student motivation and interest to learn the subject (Cornelius – White, 2007).

One key factor that fosters the effectiveness of Small Group and Peer Tutoring strategies is motivation. Motivation can be facilitated, according to self-determination theory (Dec. & Ryan, 1985), by creating an environment in which a sense of competence, autonomy and relatedness are present. When a classroom is overly controlled devoid of distractions it can stifle students' motivation because it eradicates the students sense of autonomy (Niemiec & Ryan, 2009). Ryan and Deci (2002), are of the view that effective teachers can nurture the development of students motivation in an academic task or subject by creating an environment that allows student to work autonomously, while providing support guidance and positive feedbacks even as facilitating agents in such instructional Small group and Peer tutoring strategy. Reeve, (2002), asserts that this supportive classroom environment could involve teachers listening and providing responses to their questions, and even their needs in the process.

Research efforts have shown that students are more engaged in student-centered learning, when they are working together in Small Group and Peers and even individually than listening to a teacher lecture (Shenoff, Schneider & Shernoff, 2003).

Research findings drew conclusions that an effective teachers ensures that student are actively involved in their own learning process. (Shernoff, Cslkszentmchalyi, Schneider 2003, Yair, 2000).

Peer Tutoring, Small Groups work and even peer mentoring are effective strategies that promote student engagement and are linked to achievement (Hattie, 2009). Research have also shown that when comparing cooperative (Small Group Peer Tutoring), competitive and individualistic learning models, findings points to the effectiveness of cooperative over competitive and individualistic learning (Rose shine, Johnson & Johnson, 2008).

Benefits for Students Achievement and Retention in Tutors and Tutee

Ezenwosu and Nworgu (2013) are of the view that the Nigeria educational system over the years has placed too much emphasis on the conventional traditional. Lecture Method as the main instructional strategy in our classrooms. Lecture Method according to them is seen as the oral presentation of ideas, concepts and subject matter and principles to students. It is known as a one way flow of communication from the teacher to the students, Nworgu (2009). This method make the student passive and is too teacher centered, eventually leading to boring lesson and probably under achievement in subject by these naïve students. Ezenwosu and Nwogu explain that one major advantage of the Lecture Method in ground covering with regards to syllabus before conduct of examinations. However the much grounds covered by this

conventional method, it is not effective enough for teaching of science subjects, Biology in particular.

Ezenwosu and Nworgu (2013), are on the same page with (Rohrbeck, Ginoburg, Block, Frutuzzo & Miller: 2003) when they advocate Small group Peer tutoring learning strategy as one such interactive method that may enhance students interest. According to Rohrbeck et al, (2003), Small Group Peer Tutoring encourages students' partnership linking high achieving students with however achieving ones for structured reading and information exchange among student during science lessons, Biology inclusive. Peer tutoring is a process by which students with the guidance from the teacher help by teaching one or more peers to learn skills or concept. (Golding, Lisa & Tennant, 2006). This learning strategy provides the teachers with the ability to accommodate a classroom with diverse students to improve achievement manage across ability levels and content areas, Liz and Nathen (2007).

Starr (2009), asserts that previous studies have shown the effectiveness of Small group Peer tutoring in relation to achievement and social impact in schools level. She further goes on to postulate that the inherent collaborative feature plays a major role in constructive cognitive development, since learning occurs with the interaction of the immediate environment. This strategy provides an intervention tool for teacher to promote interactive partnership that creates natural learning environment in which all students take an active role in learning, rather than the Lecture Method classroom set up where students can easily become passive. It is worth knowing that students could become teachers and teachers as facilitators.

According to Savery and Duffy (2001), student to student interaction and cooperation leads to knowledge acquisition through social negotiation among peers, with the social environment as critical factors in the development of individual understanding and knowledge.

Peer tutoring teaching strategy according to Tiwari (2014), is beneficial to both tutors and tutees with special regards to achievement and retention abilities. Currently, Tiwari believes there is sufficient research evidences on the benefits of peer tutoring. Peer Tutoring with regard to research, has been used across subjects and has been found to result in improvement in achievement for a diversity of learners within a range of content area, Biology inclusive. Peer Tutoring involves both cognitive and social gains in high performing tutors and on performing tutees in individualized positives ways.

Tiwari cites a few benefits to include the following:

- Students receive more time for individualized learning.
- Peer tutors reinforce their own learning by instructing others (tutees)
- Direct interaction between students (peer) promotes active learning
- Students feel comfortable and open when interacting with a peer or peers in small groups
- Peers and students show a similar discourse, allowing for greater understanding.

Teachers have more time to prepare and focus on the next lesson.

Small group tutoring learning strategy would be beneficial to the tutors in the following ways:

- Give Tutors the opportunity to develop their leadership skills.
- Give tutors great self confidence, self esteem and mastery.
- Helps tutors to develop cognitive, social behaviors and overall discipline

Tutees:

- Makes tutees feel at ease and concentrate better on the subject matter, with a peer tutor rather than a professional teacher.
- Helps tutees receive individualized instructions even in small groups
- Tutees may respond better to their peers than to their teacher.
- Tutees receive more teaching
- Tutees receive or obtain companionship from student that tutor them
- Teaching peers is one of the best ways to develop mastery

Empirical Studies on Small Group Teaching Strategy

Small group teaching which in another variation of Peer tutoring except that it is not one-on-one type and incorporates the teacher is also a form of student-centered and collaborative teaching or come strategy which ensures students effective construction of knowledge. This strategy allows teachers to better observe how individual students perform tasks and interact with each other collectively for group success.

Much research work has not being carried out in Nigeria on Small group teaching, so scanning of related empirical studies for now might be difficult but a few result oriented researches have been carried out in recent times. Imo, et al (2013) in their study on "Comparative effects of Small Group and team teaching method on student's academic performance in Biology" investigated students achievement. Using 120 students (SSII) drawn from two (2) secondary schools used a pre-experimental design for their study. Their results showed that students taught using team learning method performed academically better than those taught using Small group teaching strategy. Their result also showed that male and female students in

the teaming learning experimental group also performed better than male and female in small group.

Empirical Studies on Peer Tutoring Strategy

Peer tutoring strategy is a student- centered approach on teaching and learning in small groups and is characterized by specific role taking. A form of cooperative and collaborative strategy, it promotes students' engagement and is highly linked to students' achievement and retention in most case, since research findings have in recent times shifted both ways (Benefits and No Benefits.) Scanning of related research findings on Peer Tutoring strategy on achievement and retention tilts both ways.

In 2013, a meta – analysis of the academic impact of Peer tutoring was conducted by a team of American academics led by LISC Bowman. Perrott. Her research summarized the key reason, why Peer tutoring program tend to have positive impact. The core components of Peer tutoring (frequent opportunities to respond, increased time on task, regular and immediately feedback) have each been empirically linked with increased academic achievement.

Lumpe and Staver (1995), examined the effect of peer collaboration on 25 high school Biology students acquisition of concepts related to photosynthesis and interaction in Collaboration Peer Group (CPG) situation to establish how their interaction relate to the development of concepts associated with photosynthesis. The results suggested that subjects working in peer group achieved academically more in scientifically correct concepts of photosynthesis than the subjects working alone.

Dixon and Gudan (2000), conducted a study to measure the impact of peer-assisted learning program on students' academic performance. The study reported that peer-assisted

learning participants had more participation and significantly lower withdrawal rate compared with non-participants.

Berry (2002), reported a Peer tutoring program in which elementary students are paired with sixth or seventh graders who have been carefully selected and trained to be tutors. Tutors guide younger students through their homework and help them with reading skills. He concluded the benefits were indentified in both the younger and older students improvement in the students' academic achievement on Mathematics and English test preceded for two years.

Topping and Bryce (2004), in an experimental study, evaluated the effect of Peer Tutoring in thinking skills. A study aimed to partial the impact of quality of thinking of peer tutored thinking intervention from that of peer tutored reading intervention. In phase one of the study, a paired reading intervention was implemented for six (6) weeks for all groups. In phase two, the experimental classes of tutors and tutees engaged in pair thinking, while control group continued with pair reading. Post test assessment indicated significantly better performance in thinking skills for experimental tutees than control tutees.

Topping (2006), carried out a research work focusing on cross-age Peer Tutoring in which older students tutor younger ones. The general idea was for the older tutors stimulating the tutees knowledge construction and self-directed learning during online task-based interaction. The results reveal that peer tutors often provide organizational and social support which facilitates tutees knowledge construction and concentrate on improving on learning and achievement.

Hovarth (2011), in his work on "Effect of Peer Tutoring on Student Achievement," using selected students in sixth grade classroom. The research was carried out for over four (4) weeks

period using four (4) sixth grade female students and investigating the retelling scores. Two of the four female students engaged in a Peer Tutoring activity, orally reading and discussing passages together. The remaining two students read individually the same passages. Each of the four female students then individually gave a retelling of the passages to the researcher. The results demonstrated higher average retelling scores for the students engaged in the Peer Tutoring activity. Their findings indicated Peer Tutoring as an effective instructional strategy, resulting in higher student achievement.

Azubuike (2014), carried out a study on the "Effects of Peer Tutoring Instructional Strategy on Achievement in Biology of Secondary School Slow Learners in Anambra State," using a quasi experimental design, sampled a total of 42 senior secondary II Biology slow learners drawn randomly from secondary school in Awka, Anambra State. Results revealed that slow learners taught using peer tutors in the experimental group performed significantly better than those taught by expository methods in the control group, with the experimental group (peer tutoring) having a higher mean gain score.

Scanning of related research work on Peer tutoring on students achievement are much on the gain/benefits but Solomon and Crowe (2001), examined a Peer tutoring model from the perspective of the student tutor. Results revealed and reported that students could not cope with basic facilitation skills and had difficulty in separating the role of student from that of tutors.

On Peer Tutoring and students retention, scanned research work, Kumar and Bindhu (2002) carried out an experiment using peer teaching as a built-in-strategy alone with co-operative learning and concluded from their research result, found improved retention due to peer teaching in case of standard VII pupils.

Contrary to the findings of retention gain by the use of Peer Tutoring strategy Dill and Boykins (2000), researching on the effect of communal learning, Peer tutoring and individual learning on the text recall of African American fifth grader concluded from their results that communal learning students gained significantly more on recall of or retention on text than Peer Tutoring and individual learning participants.

From the foregoing, scanning of empirical related research works, it is evident that these two strategies (Small Group and Peer Tutoring) in contrast to the traditional conventional teaching have an in built mechanism by which knowledge gains can be made, evaluated discussed and challenged in a joint interaction of teacher and students even when in sonic cases, the teacher act as a facilitator. Therefore, these teaching strategies which focus on student cooperative and collaborative learning, if well implemented can bring a new dawn in instructional method in the teaching of science subjects, Biology in particular.

Appraisal of the Literature Reviewed

Teaching can only be seen as effective when the strategies employed bring(s) about a desirable change in behavior of the learner. Recent research findings have recognized teaching strategies and methods among other factors as being responsible for good achievement in science subjects. It is therefore paramount for science teachers, researchers and educational policy planners to devise instructional strategies among other factors that will bring out the best from the science students. Learning is only complete when a concept is completely understood in depth, structure, application and relevance, taking special cognizance of constant feedbacks to evaluate the extent to which teaching and learning have occurred. Biology teachers need to devise and modify existing innovative, student-centered and collaborative strategies in

instructing basic knowledge and be conversant with the present day pedagogy for effective curriculum delivery in Biology.

Research works from previous studies on the effects of small group, Peer Tutoring and some other innovative teaching strategies on students' achievements and retention in Biology indicated that Small group and Peer tutoring teaching enhanced students' achievement and retention in Biology more effectively than the conventional Lecture Method used in most public schools. However, no study was identified to have investigated into the effects of Small group and Peer tutoring teaching strategies on students' achievement and retention in secondary school Biology in Delta State, hence there is the need for this research work.

This research work will also investigate the influence of sex on students' achievement and retention in Biology, since literature reviewed indicated that there is no consensus being reached and accepted as regards the effect of sex and students' achievement and retention in Biology. While some research work indicated that sex differentiation existed, other research works indicated that no sex differentiation existed on students' achievement and retention in Biology.

This study, in view of the limited research work on the effect of Small Group and Peer Tutoring on students' achievement and retention in Biology and the inconclusive issue of the influence of sex is thus necessitated.

CHAPTER THREE

RESEARCH METHOD AND PROCEDURE

This chapter is presented under the following sub-headings:

- Design of the Study
- Population of the Study
- Sample and Sampling Techniques
- Research Instruments
- Validation of the Instrument
- Reliability of the Instrument
- Treatment Procedure
- Method of Data Analysis

Design of the Study

This research work employed a pre-test, post-test, control group, non-randomized quasi experimental 2 x 3 x 3 factorial designs. The design employed intact classes for all groups involved (both experimental and control groups), so as to ensure non-alteration of regular class periods and allow maximum control of extraneous variables. The design also justified the randomly selected public secondary schools to be used for the study. The design consisted of three instructional groups:

a. Experimental group I (Small Group Teaching).

b. Experimental group II (Peer Tutoring Strategy)

c. Control group (Lecture Method).

Experimental group I comprised Biology students exposed to Small Group Strategy teaching (Teaching involved the use of Lecture Method). Experimental group II comprised Biology students that were exposed to Peer tutoring, while the Control group comprised Biology students that were exposed to the Lecture Method.

The design consists of three instructional groups (Small Group Strategy, Peer tutoring Strategy and Lecture Method) which are the independent variables together with sex (male and female which was the moderator variable). The dependent variables are the students' achievement and retention measured by the Students Biology Achievement Test (SBAT) and repeated testing (pre-test, post-test and delayed test /retention test).

The variable matrix of the design is presented thus:

O_1 X_1 O_2 E_1 O_3

O_4 X_2 O_5 E_2 O_6

O_7 X_a O_8 C_a O_9

O_1 O_4 O_7 – Pre-test for experimental and control groups

X_1 X_2 – Treatment for the two experimental groups

Xa – Treatment for the control group

O_2 O_5 O_8 – Post-test for experimental and control groups

O_3 O_6 O_9 – Follow up test for experimental and control group

E_1 E_2 –Experimental Groups (Small Group and Peer Tutoring strategies)

C_a– Control group (Lecture Method).

This design was adopted because it allows for separate determination of main effect, as well as the interaction effect of both the independent and moderating variables on students' academic achievement and retention in Biology (dependent variables).

Population of the Study

The population of this research work comprised all senior secondary class II (SS II) Biology students in all public secondary schools from the three Senatorial Districts of Delta State. There are thirty thousand, eight hundred and thirteen (30,813) senior secondary II (SS II) Biology students and four hundred and thirty six (436) public secondary schools in the three senatorial districts of Delta State.

Table 1: Population by Senatorial District, Local Government Area, School and Number of SSII Students

Senatorial Districts	Name and Number of L.G.A	Number of Schools	SS II Student's Population
Delta	Bomadi	9	
South	Burutu	19	9,560
	Isoko North	17	
	Isoko South	19	
	Patani	9	
	Warri North	10	
	Warri South	17	
	Warri South-west	6	
		106	
Delta	Aniocha North	18	
North	Aniocha South	19	10,047
	Ika North East	18	
	Ika South	18	
	Ndokwa East	26	
	Ndodwa West	20	
	Oshimili North	12	
	Oshimili South	10	
	Ukwani	13	
		154	
Delta	Ethope East	25	
Central	Ethope West	22	
	Okpe	16	11,206
	Sapele	16	
	Udu	14	
	Ughelli North	42	
	Ughelli South	25	
	Uvwie	16	
		176	
Total	**25**	**436**	**30,813**

Source*: Post Primary Education Board, Asaba (PPEB, 2015)*

The choice of the senior secondary II (SSII) students were to ensure that students used for the study were already familiar with the subject and not under any pressure preparing for any external examination.

Sample and Sampling Techniques

The sample size of this work was six public secondary schools from the four hundred and thirty six (436) public Schools in Delta State, six intact classes of Senior Secondary II students from the six chosen Schools, Two hundred and thirty eight (238) senior Secondary II students, six research assistants from the six selected public Schools.

Table 2: Sample Distribution showing No. of schools, No. of intact-classes, No. of students, No. of research assistants

No of Schools	No of Intact-Classes	No of Students	No of Research Assistants
Obiaruku G/S, Obiakuru	1	44	1
Abbi G/S, Abbi	1	42	1
Igbonine G/S, Ozoro	1	38	1
Urhuoka G/S, Abraka	1	25	1
St Michael's College, Oleh	1	58	1
Aragba G/S, Aragba	1	31	1
TOTAL	6	238	6

Source*: Fieldwork, 2017.*

Table 3: Distribution of schools based on teaching method/strategies

GROUPS	METHODS	SCHOOLS
Experimental 1	Small Group	Obiaruku G/S, Obiaruku Abbi G/S, Abbi
Experimental 2	Peer Tutoring	Igbonine G/S, Ozoro Urhuoka S/S, Abraka
Control	Lecture	St Michael College, Oleh Aragba G/S Aragba

Source*: Fieldwork, 2017.*

The study employed purposive and random Sampling techniques for all stages of selection. At the first stage, purposive sampling was used in selecting six schools from the total of four hundred and thirty six (436) public secondary schools, from the three senatorial districts, across the twenty-five local governments Area in the State. Purposive sampling, since it is a deliberate effort to ensure that two schools each are chosen from the three senatorial districts of the state. Secondly, the selected schools were randomly assigned to Experimental and control groups through a "hat and draw" method: Randomly so as to eradicate any form of bias in the selection. Thirdly, the researcher used simple sampling technique to select six intact classes of Senior Secondary II comprising two hundred and thirty eight (238) students and six Biology teachers from the selected six public secondary school sampled.

Research Instrument

This study used one research instrument and three different lesson plans (Instructional package). The research instrument is called Students' Biology Achievement Test (SBAT). The Students' Biology Achievement Test (SBAT) was developed by a selection and compilation of test items on the topics of Sense Organs, Reproduction in Animals and Reproduction in Plants

drawn from 2010- 2014 West African Senior School Certificate Examinations (WASSCE) and National Examination Council (NECO) question papers.

The three lesson plans (instructional packages) are comprehensive lesson plans drawn from topics of Sense Organs, Reproduction in Animals and Reproduction in Plants for senior secondary II (SSII) taught using Small group strategy, Peer tutoring and Lecture Method respectively for six weeks.

The research instrument was designed to assess the students' level of achievement and retention in Biology. The Students' Biology Achievement Test (SBAT) consisted of two sections. Section A and B. Section A consisted of personal data of the subjects like Name, school and sex. Section B contains forty (40) multiple test items with four options (A-D). Students were required to choose or mark the option in line with their answers on each item from the presented options A – D. See Appendix II for Research Instrument (SBAT), Appendix III, IV and V, for Instructional Packages (lesson plans for Small Group strategy, Peer Tutoring and Lecture Method) respectively.

Validation of the Instrument

The Students Biology Achievement Test (SBAT) together with a criterion validation form and three lesson plans (instructional package), was given to three experts in the field of Biology Education, Curriculum Studies and Measurement and Evaluation Departments to make input on the face and content validities. These experts were asked to determine the face validity on the suitability of the test items for the target population in terms of clarity, breadth and language. The researcher also carried out a construct validity (Item analysis) using 20 students test scores in the pilot group. Under the item analysis, two indices were computed namely the

item difficulty level and the item discrimination index. (see appendix vi) Finally the researcher carried out a content validity (see Table of Specification)

This intense scrutiny reduced the student's Biology Achievement Test (SBAT) items to Thirty (30) multiple choice questions from the original forty (40) questions due to the detection of unsuitable and ambiguous test items. (See appendix VIII for Criterion Validation Form). On the whole, 30 questions were chosen out of 40 questions. (See Appendix ii)

Students Biology Achievement Test

Table of Specification (blue print)

	Objectives						
Content Area	**Knowledge 30%**	**Comprehension 23%**	**Application 17%**	**Analysis 7%**	**Synthesis 20%**	**Evaluation 3%**	**Total 100%**
Sense Organs Organ of taste (Tongue), smell (Nose), touch and feeling (Skin) sight (Eye), hearing and balancing (Ear and nose). **33%**	2	2	2	1	2	1	10
Reproduction in Man (Male and female reproductive organ, structure and function of sex gametes. **20%**	1	2	1	1	1	-	6
Reproduction in Animals Stages of development in toad, housefly and cockroach. **14%**	1	1	1	-	1	-	4
Reproduction in Animals (comparison of fish, reptile, birds, amphibian and mammal **3%**	1	-		-	-	-	1
Reproduction in Flowering plants, structure and functions of flowering plants and functions of a flower **10%**	1	2		-	-	-	3
Reproduction in Flowering plants, pollination, condition and types of pollination **3%**	1	-	-	-	-	-	1
Reproduction in Flowering Plants, Fertilization in plants, fruits, classification of fruits, types of dispersal **17%**	2	-	1	-	2	-	5
TOTAL	**9**	**7**	**5**	**2**	**6**	**1**	**30**

Reliability of the Research Instrument

The reliability of the research instrument called Students Biology Achievement Test (SBAT) was determined using Kuder-Richardson 21. Reliability coefficient of 0.81 for Student Biology Achievement Test (SBAT) was obtained.

Treatment Procedure

a. Training of Peer Tutors

During the training, the peer tutors were taught on how to behave with their slow and low ability peers. The Peer tutors were trained on the following procedure and ways:

- The peer tutors were taught and guided on how to use simple language to teach each Biology concept using the language level of the tutees for easy understanding.
- They (Peer tutors) were trained to how to teach the Biology concepts sequentially to the tutees following the lesson step by step.
- They (Peer tutors) were exposed to how to use instructional materials like charts, models and flash cards.
- They (Peer tutors) in training were taught how to dialogue with their tutees qualitatively, different from the conventional classroom dialogues.
- During the training, strong importance was shown to the peer tutors on how collaborative efforts improve the understanding of students by encouraging, hinting, telling, questioning, demonstrating, explaining and summarizing and how to use immediate feedbacks.

At the end of the training program, the best ten peer tutors out of the fourteen were selected and used for the study, placing the remaining four on standbys.

b. Training of Research Assistants (Regular Biology Teachers)

On the training of the regular Biology teachers (research assistants), the researcher briefed those in experimental schools on how to group the students into small groups of threes and fours based on the class size and ratio of peer tutors and tutees. The researchers also highlighted how to monitor the groups during the tutoring process, acting as facilitators in the process (Experimental group II) and when necessary, ensuring usage immediate feedback.

At the end of the training of the research assistants (regular Biology teachers) for the experimental and control group, the researcher handed over copies of the comprehensive lesson plans (instructional packages) prepared, comprising six instructional units to be used and instructional materials like charts, textbooks and models. Each lesson was shared into two periods in a week.

A pre-test was administered to students in both experimental and control groups a week before the commencement of the treatment. The treatment lasted for six weeks. During this time the assistant researchers (regular Biology teachers) adhered strictly to the adopted instructional procedures specified for the treatment. The same test was re-administered to the subjects in both experimental and control groups (post-test) on the seventh (7^{th}) week. Four weeks after the post-test, a follow-up test was administered to all groups (Retention Test). See Appendix XI, XII, XIII for pre-test, post-test and delayed test

A formal application letter from the researchers was presented to the principals to obtain official permissions from the six selected schools of the subjects to participate in this study. The six regular Biology teachers in the selected schools served as research assistants. Four of the teachers serving as instructors (Small Group teaching and Lecture Method) and two as facilitators (Peer Tutoring Strategy). The teachers were given training on the purpose of the

study to ensure uniformity and mastery of the teaching approaches upon which the research work was based enabling the teachers (research assistants) applies the techniques accordingly.

Biology students in the experimental group I (Small Group strategy) was divided into groups A, B, C, D, and E of 8 members each in each group. The class sitting arrangement was altered to suit the groupings. Students of each group were instructed to share ideas and work together collectively, assist one another work as a compact team, provide answers by consensus whenever the teacher asks question to their group. Here Lecture Method was used for lesson delivery by the research assistant. The research assistant moved from group to group to monitor the students on their group class assignment.

Biology students in the experimental group II (Peer tutoring) were divided into Small Group peer tutoring; the trained peer tutors carried out the role of tutoring throughout the programme. Each of the selected peer tutors was assigned to a specific group. Here again the sitting arrangement was altered, breaking the large class into small groups and urge the peers to work in collaboration and as a team throughout the programme. During the lesson here the research assistant served as a facilitator, supervising and monitoring all the activities. Instructional charts and materials were shared to groups in the class. Biology students in Control group were taught as in regular Biology classes not altering the class settings by the regular Biology teacher. The Lecture Method was the means of instruction in the group.

The researcher and the two research assistants (teachers) serving as facilitators in the two schools used for Experimental Group (II) (Peer Tutoring) helped to identify the peer tutors. The regular Biology teachers (research assistants) in their schools selected only the high ability students (fast learners) that were willing to teach their fellow peers. Fourteen high ability students were identified by the teachers (eight boys and six girls) and trained on how to tutor

their peers. These fourteen (14) selected peer tutors were trained by the researcher and the training lasted for one week at one hour per training day.

The researcher carried out the training based on how to conduct instructional procedures of delivering a Peer Tutoring lesson. The training of the selected peer tutors and researcher's assistants (teachers) effectively were desired by the objective of this research work and crucial for the experiment.

Method of Data Analysis

Mean and Standard Deviation was used in analyzing all the research questions while Analysis of Variance (ANOVA), Analysis of Covariance (ANCOVA) and t-test were used in analyzing the hypotheses. Also post-hoc multiple comparisons was done using Bonferreni test to indicate the direction of the significant differences. All the hypotheses were tested at the 0.05 level of significance.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION

This chapter deals with the analysis, interpretation and presentation of data obtained through the application of the procedures in chapter three.

The study looked at the effects of three different teaching (Small group strategy, peer tutoring and lecture) methods on secondary school students achievement and retention in Biology.

Presentation of Results

Answering of Research Questions and testing of Hypotheses

Research Question One: What is the difference in the mean achievement test scores of Biology students exposed to Small Group teaching strategy, peer tutoring strategy and lecture method?

Table 4: Biology Achievement of Secondary School Students exposed to small group, Peer tutoring and Lecture Teaching Methods.

Variable	N	Pre-Test		Post-Test		Mean Achievement Gain
		Mean	SD	Mean	SD	
Small Group Teaching	87	11.82	3.54	17.20	4.59	5.38
Peer Tutoring	63	10.90	2.38	12.00	2.55	1.10
Lecture Method	88	13.67	4.19	16.20	3.41	2.53

Table 4 shows the mean and standard deviation of the Pre-test and Post Test of the three types of instructional strategies. The Small group teaching shows that the mean score for the pre-test was 11.82 while the standard deviation was 3.54, the post-test mean score was 17.20 and a standard deviation of 4.59. With respect to peer tutoring strategy, the pre-test mean score was 10.90 and a standard deviation of 2.38 while the post-test score of 12.00 and standard deviation of 2.55 was obtained. The Table 4 also showed that students taught with lecture method had a pre-test mean score of 13.67 and a standard deviation of 4.19 while the post-test score was 16.20 and standard

deviation of 3.41. The mean achievement gains for the three teaching methods showed that students expose to small group teaching strategy had the highest achievement gain of 5.38 followed by lecture method with a gain of 2.53 and peer tutoring having the least mean achievement gain of 1.10. Therefore, there is significant difference in the mean achievement test scores among Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method.

Hypothesis One ($H0_1$): There is no significant difference in the mean achievement test score among Biology students exposed to small Group teaching strategy, peer tutoring strategy and lecture method.

The pre-test significant difference in the mean achievement test scores among Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method have been verified using t-test statistics and is shown in appendix XI.

Table 5: Summary of ANCOVA test of Significant difference in the Biology Mean achievement of Secondary School Students exposed to small group, Peer tutoring and Lecture Teaching Methods.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1811.235[a]	3	603.745	56.796	0.00
Intercept	1526.876	1	1526.876	143.638	0.00
Group[*]	**812.513**	**2**	**406.256**	**38.218**[*]	**0.00**
Pre-test	745.984	1	745.984	70.177	0.00
Error	2498.054	235	10.630		
Total	61404.00	238			
Corrected Total	4309.289	238			

$P < 0.05$

Table 5 shows the Biology mean achievement comparison of the post-test scores of students in the various experimental groups using ANCOVA analysis. The Table 5 showed that the F calculated value of 38.218 is greater than the F-critical value of 3.04 ($F_{0.05}$ (2,235) = 3.04). Based on this, the null hypothesis

(Ho_1) is hereby rejected. This indicates that there is a significant difference in the mean achievement test scores of Biology students exposed to small group teaching strategy, peer tutoring and lecture methods. To indicate the direction of the significance, the Post-hoc multiple comparisons was done across teaching methods.

Table 6: Post-hoc Multiple Comparison across Three Teaching Methods

Group		Mean Difference	Std. Error	Sig.	Direction
Small Group Teaching	Peer Tutoring	4.739*	0.542	0.00	Significant
	Lecture Method	1.923*	0.504	0.01	Not significant
Peer Tutoring	Small Group	-4.739*	0.542	0.00	Significant
	Lecture Method	-2816*	0.562	0.00	Significant
Lecture Method	Small Group	-1.923*	0.504	0.01	Not significant
	Peer Tutoring	2.816*	0.562	0.00	Significant

Table 6 showed that students taught with small group teaching performed better than those taught with peer tutoring as there was a mean difference of 4.739, likewise, students taught with small group teaching performed better than those taught with lecture method and showed a mean difference of 1.923. On comparing those taught with peer tutoring and lecture method, it revealed that those taught with lecture method performed better as the mean difference between them was -2.816. All of the mean differences were significant as $p<0.05$

Research Question Two: What is the difference in the mean achievement test score of male Biology students exposed to Small Group teaching strategy, Peer Tutoring Strategy and Lecture Method?

Table 7: Summary of Biology Achievement of Secondary School Male Students Exposed to Three Methods of Teaching

		Pre-Test		Post-Test		Mean Achievement Gain
Variable	**N**	**Mean**	**SD**	**Mean**	**SD**	
Small Group Teaching	49	11.69	3.36	16.751	5.01	5.06
Peer Tutoring	37	11.13	2.68	12.966	2.67	1.82
Lecture Method	48	14.47	4.07	14.989	3.46	0.52

Table 7 presents the mean achievement scores of male students taught with different teaching methods at the Pre-test and Post test. It was shown that male students exposed to small group teaching had a pre-test mean and standard deviation score of 11.69 and 3.36 respectively. Likewise, those exposed to peer tutoring had a mean and standard deviation of 11.13 and 2.68 and those exposed to lecture method had 14.47 and 4.07. In the post-test score however, the students exposed to small group teaching had a mean score of 16.751 and a standard deviation of 5.01 while those exposed to peer tutoring had a posttest mean score of 12.966 and a standard deviation of 2.67. The mean and standard deviation score of those exposed to lecture method is 14.989 and 3.46 respectively. The difference in the mean achievement test scores of male Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method was significant.

Hypothesis Two($H0_2$): There is no significant difference in the mean achievement test Score of male Biology students exposed to Small Group teaching strategy, peer tutoring strategy and lecture method.

Table 8: Summary of ANCOVA Test of Significant difference in the Biology Mean achievement of Male Secondary School Students Exposed to small group teaching strategy, peer tutoring and lecture method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	949.617[a]	3	316.539	28.724	0.00
Intercept	577.906	1	577.906	52.441	0.00
Pre-test	516.610	1	516.610	46.879	0.00
Group*	**302.088**	**2**	**151.044**	**13.706***	**0.00**
Error	1443.642	131	11.020		
Total	33069.00	135			
Corrected Total	2393.259	134			

$P < 0.05$

Table 8 shows the mean achievement comparison of the post-test scores of male Biology students in the various experimental groups using ANCOVA analysis. The table showed that the F calculated value of 13.706 is greater than the F-critical ration of 3.07 ($F_{0.05}$ (2,131) = 3.07). Based on this, the null hypothesis (Ho_2) is hereby rejected. This indicates that there is a significant difference in the mean achievement test scores of male Biology students exposed to small group teaching strategy, peer tutoring and lecture methods. To indicate the direction of the significance, the Post-hoc multiple comparison was done across teaching methods and presented in Table 8.

Table 9: Summary of Post-hoc Multiple Comparison of Male students Biology Achievement exposed to small group teaching strategy, peer tutoring and lecture method

Group		Mean Difference	Std. Error	Sig.	Direction
Small Group Teaching	Peer Tutoring	3.785*	0.724	0.00	Significant
	Lecture Method	1.782*	0.709	0.04	Not significant
Peer Tutoring	Small Group	-3.785*	0.724	0.00	Significant
	Lecture Method	-2.023*	0.774	0.00	Significant
Lecture Method	Small Group	-1.782*	0.709	0.04	Not significant
	Peer	2.023*	0.774	0.03	Not

	Tutoring		significant

Table 9 showed that male Biology students taught with small group teaching performed better than those taught with peer tutoring as there was a mean difference of 3.785, likewise, male Biology students taught with small group teaching performed better than those taught with lecture method and showed a mean difference of 1.782. On comparing those taught with peer tutoring and lecture method, it revealed that those taught with lecture method performed better as the mean difference between them was -2.023. All of the mean differences were significant as $p<0.05$

Research Question Three: What is the difference in the mean achievement test score of female Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method?

Table 10: Summary of Biology Achievement of Secondary School Female Students Exposed to Three Methods of Teaching

		Pre-test		Post-Test		Mean Achievement Gain
Variable	**N**	**Mean**	**SD**	**Mean**	**SD**	
Small Group Teaching	38	11.97	3.80	18.39	4.00	6.42
Peer Tutoring	26	10.58	1.88	11.77	2.41	1.19
Lecture Method	40	12.70	4.18	15.78	3.77	3.08

Table 10 presents the mean achievement scores of female students taught with different teaching methods at the Pre-test and Post test. It was shown that female students exposed to small group teaching had a pre-test mean and standard deviation score of 11.97 and 3.80 respectively. Likewise, those exposed to peer tutoring had a mean and standard deviation of 10.58 and 1.88 and those exposed to lecture method had 12.70 and 4.18. In the posttest score however, the students exposed to small group teaching had a mean score of 18.39 and a standard deviation of 4.00 while those exposed to peer tutoring had a posttest mean score of 11.77 and a standard

deviation of 2.41. The mean and standard deviation score of those exposed to lecture method is 15.78 and 3.77 respectively. There was significant difference in the mean achievement test scores of female Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method.

Hypothesis Three($H0_3$): There is no significant difference in the mean achievement test Score of female Biology students exposed to Small Group teaching strategy, peer tutoring strategy and lecture method.

The pre-test significant difference in the mean achievement test scores among Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method have been verified using t-test statistics and is shown in appendix XI

Table 11: Summary of ANCOVA Test of Significant difference in the Biology Mean achievement of Female Secondary School Students Exposed to small group teaching strategy, peer tutoring and lecture method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	939.356[a]	3	313.119	30.868	0.00
Intercept	609.607	1	609.607	60.097	0.00
Pre-test	260.640	1	260.640	25.695	0.00
Group*	**555.194**	**2**	**277.597**	**27.366***	**0.00**
Error	973.804	96	10.144		
Total	26814.000	100			
Corrected Total	1913.160	99			

$P < 0.05$

Table 11 shows the mean achievement comparison of the post-test scores of female Biology students in the various experimental groups using ANCOVA analysis. The Table showed that the F calculated value of 27.366 is greater than the F-critical ratio of 3.09 ($F_{0.05}$ (2, 96) = 3.09). Based on this the null hypothesis (Ho_3) is hereby rejected. This indicates that there is a significant difference in the mean achievement test scores of female Biology students exposed to

small group teaching strategy, peer tutoring and lecture methods. To indicate the direction of the significance, the Post-hoc multiple comparison was done across teaching methods and presented in Table 11.

Table 12: Summary of Post-hoc Multiple Comparison of Female students Biology Achievement exposed to small group teaching strategy, peer tutoring and lecture method

Group		Mean Difference	Std. Error	Sig.	Direction
Small Group Teaching	Peer Tutoring	5.937*	0.822	0.00	Significant
	Lecture Method	3.272*	0.757	0.00	Significant
Peer Tutoring	Small Group	-5.937	0.822	0.00	Significant
	Lecture Method	-2.665	0.870	0.009	Not significant
Lecture Method	Small Group	-3.272*	0.757	0.00	Significant
	Peer Tutoring	2.665	0.870	0.009	Not significant

Table 12 showed that female Biology students taught with small group teaching performed better than those taught with peer tutoring as there was a mean difference of 5.937, likewise, female Biology students taught with small group teaching performed better than those taught with lecture method and showed a mean difference of 3.272. On comparing those taught with peer tutoring and lecture method, it revealed that those taught with lecture method performed better as the mean difference between them was -2.023. All of the mean differences were significant as $p<0.05$

Research Question Four: What is the difference in the mean achievement test score of male and female Biology students exposed to Small Group teaching strategy?

Table 13: Summary of Biology Achievement of Secondary School Male and Female Students Exposed to Group Teaching Strategy.

Variable		Pre-Test		Post-Test		Mean Achievement Gain
	N	Mean	SD	Mean	SD	
Male	49	11.51	3.42	16.08	3.47	4.57
Female	38	11.97	3.80	18.39	4.00	6.42

Table 13 presents the Biology achievement test scores of male and female students at the pre-test and post test respectively. It showed that the pre-test mean and standard deviation of male students were 11.51 and 3.42 while those of female students were 11.97 and 3.80. It also showed that the posttest mean achievement test scores of male students exposed to small group teaching was 16.08 and 3.47. Also the mean and standard deviation of the female students at the post test was 18.39 and 4.00. The mean achievement gain for male and female students was reported to be 4.57 and 6.42 respectively. From the above analysis, female Biology students achieved significantly better than the male students in the small group teaching strategy.

Hypothesis Four ($H0_4$): There is no significant difference in the mean achievement test Score of male and female Biology student exposed to Small Group teaching strategy.

Table 14: Summary of t-test of Differences between the mean Biology Achievement Test Score of Male and Female Students Exposed to Small Group Teaching Strategy

Variable	N	Mean	SD	DF	t-cal	T-critical
Male	49	16.08	3.47			
				85	2.88	1.980
Female	38	18.39	4.00			

$P < 0.05$

Table 14 shows the t-test comparison of posttest mean achievement scores of male and female students exposed to small group teaching strategy. The t-calculated value of 2.88 is greater than the t-critical ratio of 1.980. Based on this, hypothesis (Ho_4) is hereby rejected. This indicates that

there is a significant difference in the mean achievement test scores of male and female Biology students exposed to small group teaching strategy, this implies that female Biology students with the mean score of 18.39 achieved significantly better than the male Biology students with a mean score of 16.08 in the group taught with small group strategy.

Research Question Five: What is the difference in the mean achievement test score of male and female Biology students exposed to peer tutoring teaching strategy?

Table 15: Summary of Biology Achievement of Secondary School Male and Female Students Exposed to Peer tutoring teaching Strategy.

Variable	Pre-Test			Post-Test		Mean Achievement Gain
	N	**Mean**	**SD**	**Mean**	**SD**	
Male	45	11.13	2.48	12.11	2.53	0.98
Female	18	10.33	2.06	11.72	2.65	1.39

Table 15 shows the mean achievement comparison of the post-test scores of male and female Biology students exposed to peer tutoring teaching strategy. The pre-test mean achievement score and standard deviation of male students is 11.13 and 2.48 respectively. For the females however, the pre-test mean and standard deviation for females is 10.33 and a deviation of 2.06. Relative to the posttest, it was shown that male students had a mean and standard deviation of 12.11 and 2.53 while those of the female were 11.72 and 2.65 respectively. Therefore, from the above there was no significant difference between the mean achievement scores of male and female Biology students exposed to peer tutoring strategy.

Hypothesis Five ($H0_5$): There is no significant difference in the mean achievement test score of male and Biology students exposed to peer tutoring strategy.

Table 16: Summary of t-test of Differences between the mean Biology Achievement Test Score of Male and Female Students Exposed to Peer tutoring Teaching Strategy

Variable	N	Mean	SD	DF	t-cal	t-critical
Male	26	12.16	2.41			
				61	0.598	2.000
Female	37	11.77	2.67			

P > 0.05

Table 16 shows the t-test comparison of posttest mean achievement scores of male and female students exposed to peer tutoring teaching strategy. The t-calculated value of 0.598 is less than the t-critical ratio of 2.000. Based on this the null hypothesis (Ho_5) is hereby accepted. This indicates that there is no significant difference in the mean achievement test scores of male and female Biology students exposed to peer tutoring strategy.

Research Question Six: What is the interaction effect between the teaching strategies and Sex on student achievement in Biology?

Table 17: Summary of Univariate Analysis of Biology Achievement by Teaching Strategy and Sex

Method of Instruction	Male		Female	
	Mean	SD	Mean	SD
Group Teaching Strategy	16.27	4.84	18.39	4.00
Peer Tutoring Strategy	12.16	2.67	11.77	2.41
Lecture Method	16.08	3.46	16.35	3.37

Table 17 shows the mean and standard deviation achievement test scores of students by sex and teaching strategy. It showed that the posttest mean and standard deviation of male students exposed to the small group teaching strategy was 16.27 and 4.84 respectively while the male students exposed to peer tutoring had a post test mean of 12.16 and a standard deviation of 2.67. The male students exposed to lecture method had a pre-test mean score of 16.08 and a standard deviation of 3.46. The females on the other hand had a mean of 18.39 and a standard deviation of 4.00 for small group teaching while those exposed to peer tutoring had a score of 11.77 and a

standard deviation of 2.41 while those exposed to lecture method had a mean score of 16.35 and a standard deviation of 3.37 respectively. From the above analysis, there was no significant interaction effect between teaching strategies and sex on student's achievement in Biology.

Hypothesis Six ($H0_6$): There is no significant interaction effect between the teaching strategies and sex on student's achievement in Biology.

Table 18: Summary of Analysis of Covariance for Biology Achievement by different Teaching Strategies

Source	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1925.825[a]	6	320.971	31.242	0.000
Intercept	1472.984	1	1472.984	143.376	0.000
Sex	58.589	1	58.589	5.703	0.018
Group	834.154	2	417.077	40.597	0.000
Pre-test	759.582	2	759.582	73.936	0.000
Sex*Group	**39.038**	**2**	**19.519**	**1.900***	**0.152**
Error	2383.463	232	10.274		
Total	61404.000	238			
Corrected Total	4309.289	238			

P > 0.05

Table 18 results showed that the F-calculated value of 1.900 is less than the F-calculated ratio of 3.04 ($F_{0.05}$ (2,232) = 3.04). Based on this result, the null hypothesis (Ho_6) is hereby upheld. Based on the above observation, it implies that there is no significant interaction effect between the teaching strategies and sex on student's achievement in Biology.

Research Question Seven: What is the difference in the mean retention score of Biology students exposed to Small Group teaching strategy, peer tutoring strategy and lecture method?

Table 19: Summary of Retention Score of Secondary School Biology Students Exposed to Small group, peer tutoring and lecture method

Variable	N	Mean	SD
Small Group Teaching	87	2.01	4.19
Peer Tutoring	63	1.68	2.29
Lecture Method	88	2.55	2.75

Table 19 presents the mean and standard deviation retention scores of Biology students taught with different teaching methods. It shows that that students exposed to small group teaching strategy had a mean retention score of 2.01 and a standard deviation of 4.19 while those exposed to peer tutoring had a mean retention score of 1.68 and a standard deviation of 2.29. For those exposed to lecture method, the mean retention score was 2.55 and a standard deviation of 2.75. Put together, the highest mean retention score was lecture method followed by small group and peer tutoring respectively. Therefore, there was no significant difference in the mean retention test score of Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method.

Hypothesis Seven($H0_7$): There is no significant difference in the mean retention test score of Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method.

Table 20: Summary of ANOVA test of Significant difference in the Biology Mean Retention Scores of Secondary School Students Exposed to Small Group Teaching, Peer tutoring and lecture method.

	Sum of Squares	Df	Mean Squares	F	Sig.
Between Groups	29.573	2	14.786	1.393	0.250
Within Groups	2504.662	236	10.613		
Total	2534.234	238			

$P > 0.05$

Table 20 presents the ANOVA test of significant difference in the mean retention scores of students exposed to three different methods of teaching. The result shows that the F-calculated value of 1.393 is less than the F-critical ratio of 3.04 ($F_{0.05}$ (2,236) = 3.04). This indicates that there is no significant difference in the mean retention scores of students exposed to different

teaching methods (small group, peer tutoring and lecture method). With this result the null hypothesis (Ho_7) is hereby upheld.

Research Question Eight: What is the difference in the mean retention score of male Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method?

Table 21: Summary of Mean Retention Scores of Secondary School Male Biology Students Exposed to Small Group teaching strategy, peer tutoring strategy and lecture method

Variable	N	Mean	SD
Small Group Teaching	49	1.20	4.14
Peer Tutoring	37	1.64	2.07
Lecture Method	48	2.67	3.06

Table 21 presents the mean retention scores of male students taught with different teaching methods. It reveals that the mean retention score of male students exposed to small group teaching strategy was 1.20 and a standard deviation of 4.14 while that of those exposed to peer tutoring was 1.64 and 2.07 respectively. The male students taught using lecture method had a mean retention score of 2.67 and a standard deviation of 3.06. The retention score was observed to be highest in students taught with lecture method followed by peer tutoring and eventually small group teaching. There was no significant difference in the retention test scores of male Biology students exposed to small group teaching, peer tutoring strategy and lecture method.

Hypothesis Eight($H0_8$): There is no significant difference in the mean retention test Score of male Biology student exposed to Small Group teaching strategy, peer tutoring strategy and lecture method.

Table 22: Summary of ANOVA test of Significant difference in the male students Biology mean retention scores of secondary School Students Exposed to Small Group Teaching, Peer tutoring and lecture method. (Retention)

	Sum of Squares	Df	Mean Squares	F	Sig.
Between Groups	55.159	2	27.579	2.551	0.082
Within Groups	1427.167	132	10.812		
Total	1482.326	134			

$P > 0.05$

Table 22 presents the ANOVA test of significant difference in the mean retention scores of male Biology students exposed to three different methods of teaching. The result shows that the F-calculated value of 2.551 is less than the F-critical ratio of 3.04 ($F_{0.05}$ (2,132) = 3.07). Based on this the null hypothesis (Ho_8) is hereby accepted. This indicates that there was no significant difference in the mean retention scores of male Biology students exposed to different teaching methods.

Research Question Nine: What is the difference in the mean retention score of female Biology students exposed to Small Group teaching strategy, peer tutoring strategy and lecture method?

Table 23: Summary of Mean Retention Scores of Secondary School Female Biology Students Exposed to Three Methods of Teaching

Variable	N	Mean	SD
Small Group Teaching	38	3.05	4.08
Peer Tutoring	26	1.73	2.62
Lecture Method	40	2.44	2.44

Table 23 presents the mean retention scores of female Biology students taught with different teaching methods. It shows that female students exposed to small group teaching strategy had a mean retention score of 3.05 and a standard deviation of 4.08. Also, female Biology students exposed to peer tutoring had a mean retention score of 1.73 and a standard deviation of 2.62

while those exposed to lecture method had a mean retention score of 2.44 and a standard deviation of 2.44 respectively. Put together, the highest mean retention score was observed in female students exposed to small group teaching followed by lecture method and eventually peer tutoring. Findings from above indicates there was no significant difference in the mean retention test score of female Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method.

Hypothesis Nine ($H0_9$): There will be no significant difference in the mean retention test Score of female Biology student exposed to Small Group teaching strategy, peer tutoring strategy and lecture method

Table 24: ANOVA test of significant difference in the Female Students Exposed to Small group, Peer Tutoring and Lecture Method (Retention)

Variable	N	Mean	SD	DF	F-cal	p-value
Small Group Teaching	38	27.091	2	13.545	1.317	0.273
Peer Tutoring	997.899	97	10.288			
Lecture Method	1024.990	99				

$P > 0.05$

Table 24 presents the ANOVA test of significant difference in the mean retention scores of female Biology students exposed to three different methods of teaching. The result shows that the F-calculated value of 1.317 is less than the F-critical ratio of 3.11 ($F_{0.05}$ (2,97) = 3.11). Based on this the null hypothesis (Ho_9) is hereby upheld. This indicates that there is no significant difference in the mean retention scores of female Biology students exposed to different teaching methods.

Research Question Ten: What is the difference in the mean retention Score of male and female Biology students exposed to Small group teaching strategies?

Table 25: Summary of Differences between the mean Biology Retention Score of male and female Students Exposed to Small Group Teachings

Variable	N	Mean	SD
Male	49	2.67	3.06
Female	38	3.05	4.08

1. Table 25 shows the comparison of the mean retention scores of male and female Biology students exposed to small group teaching strategy. It showed that the mean retention score of 2.67 and a standard deviation of 3.06 was obtained by male Biology students while a mean retention score of 3.05 and a standard deviation of 4.08 was obtained. The difference between mean retention test scores of male and female Biology students exposed to small group teaching strategy was not significant.

Hypothesis Ten ($H0_{10}$): There is no significant difference in the mean retention test Score of male and female Biology students exposed to Small Group teaching strategy.

Table 26: Summary of t-test of Significant Differences between the mean Biology Retention Score of Students Exposed to Small Group Teachings

Variable	N	Mean	SD	DF	t-cal	t-critical
Male	49	2.67	3.06			
				85	0.495	1.980
Female	38	3.05	4.08			

P > 0.05

Table 26 presents the t-test of significant difference in the mean retention scores of male and female Biology students exposed to small group strategy. It showed that a calculated t of 0.495 is less than t-critical ratio of 1.980. Based on this the null hypothesis (Ho_{10}) is hereby accepted. This indicates that there is no significant difference in the mean retention score of male and female students exposed to small group teaching.

Research Question Eleven: What is the difference in the mean retention score of male and female Biology students exposed to peer tutoring strategy?

Table 27: Summary of Differences between the mean Biology Retention Score of Students Exposed to Peer Tutoring

Variable	N	Mean	SD
Male	26	1.73	2.62
Female	37	1.65	2.07

Table 27 shows the comparison of the mean retention scores of male and female Biology students exposed to peer tutoring teaching strategy. It showed that the mean retention score of 1.73 and a standard deviation of 2.62 were obtained by male Biology students while a mean retention score of 1.65 and a standard deviation of 2.07 was obtained by female students. Therefore, from analysis above, there was no significant difference between the mean retention test scores of male and female Biology students exposed to peer tutoring strategy.

Hypothesis Eleven ($H0_{11}$): There will be no significant difference in the mean retention test Score of male and female Biology students exposed to peer tutoring strategy.

Table 28: Summary of t-test of Significant Differences between the mean Biology Retention Score of Students Exposed to Peer Tutoring

Variable	N	Mean	SD	DF	t-cal	t-critical
Male	26	1.73	2.62			
				61	0.139	0.890
Female	37	1.65	2.07			

$P > 0.05$

Table 28 presents the t-test of significant difference in the mean retention scores of male and female Biology students exposed to peer tutoring strategy. It showed that a t-calculated value of 0.319 is less than the t-critical ratio of 0.890. Based on the null, hypothesis (Ho_{11}) is hereby

accepted. This indicates that there is no significant difference in the mean retention score of male and female students exposed to peer tutoring strategy.

Research Question Twelve: What is the interaction effect of the teaching strategies and sex on student retention in Biology?

Table 29: Summary of Univariate Analysis of Biology Retention by Teaching Strategy and Sex

Method of Instruction	Male		Female	
	Mean	SD	Mean	SD
Small Group Strategy	1.20	4.14	3.05	4.08
Peer Tutoring Strategy	1.65	2.07	1.73	2.61
Lecture Method	2.67	3.06	2.40	2.34

Table 29 shows the mean and standard deviation of the retention scores of students by sex and teaching strategy. It showed that the mean retention score and standard deviation of male students exposed to the small group strategy was 1.20 and 4.14 respectively while the male students exposed to peer tutoring had a mean retention score of 1.65 and a standard deviation of 2.07. The male students exposed to lecture method had a retention score of 2.67 and a standard deviation of 3.06. The females on the other hand had a mean retention score of 3.05 and a standard deviation of 4.08 for small group teaching while those exposed to peer tutoring had a retention score of 1.73 and a standard deviation of 2.61 while those exposed to lecture method had a mean score of 2.40 and a standard deviation of 2.34 respectively. There was no significant interaction effect between teaching strategies and sex in student's retention in Biology.

Hypothesis Twelve ($H0_{12}$): There will be no significant interaction effect of teaching strategies and sex on student retention in Biology.

Table 30: Analysis of Covariance for Biology Retention by different Teaching Strategies

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	312.710	6	52.118	5.443	0.00
Intercept	22.964	1	22.964	2.398	0.123
Sex	30.591	1	30.591	3.195	0.075
Group	1.103	2	0.552	0.058	0.944
Pre-test	208.253	1	208.253	21.748	0.000
Sex * Group	**32.735**	**2**	**16.367**	**1.709**	**0.183**
Error	2221.524	232	9.576		
Total	3614.000	239			
Corrected Total	2534.234	238			

$P > 0.05$

Table 30 result showed that the F-calculated value of 1.709 is less than the F-critical ratio of 3.04 ($F_{0.05}$ (2,232) = 3.04). Based on this the null hypothesis (Ho_{12}) is hereby accepted. This implies that there was no significant interaction between instructional strategies and sex on student's retention in Biology.

Discussion of Results

The objective of the study was to investigate the effect of small group teaching and peer tutoring strategies on Biology students' achievement and retention in secondary school students'. Findings from the study as presented, showed that the highest mean achievement gain was 5.38 obtained by those in the small teaching group while the least mean achievement gain of 1.10 was attained by those in the peer tutoring group. The corresponding hypothesis in line with research question one also reported a significant difference in the mean achievement scores of students in the small group and peer tutoring compared to lecture method. The multiple comparison across different groups as presented, further revealed that there were significant differences between those exposed to small group strategies relative to those exposed to peer tutoring and the lecture

method. In the same vein, there were observed differences in the achievement scores of those exposed to peer tutoring strategy and the lecture method. This observed trend occurred irrespective of sex relative to research questions two and three and hypotheses two and three.

The observed trend and differences in the achievement of students in the small group teaching strategy and the peer tutoring may have risen from the role of the teacher in the teaching process. According to Imo *et al*., (2012), Small group teaching provides opportunities for hands-on activities for students that results in products in which students' perform mental operations. It implies that students sit in small groups where they can learn and help each other (co-operative teaching) while the teacher moderates and monitors the process. In Peer tutoring strategy however, it is seen as the approach to learning instruction in which one student teaches another student in materials on which the first is a tutor and the second is a tutee (Mickelson et al., 2003). Unlike peer tutoring where in most cases, a student is always in a position of a tutor while others are tutees, the small group strategy offers a better opportunity for students to freely interact and open up to themselves towards resolving their inadequacies and confusions. It thus offers better opportunities for them to be part of the process rather than being at the receiving end of instruction, (Cruickshank, 2003)

The higher mean achievement gain score obtained is in agreement with the finding of Nnorom (2015) who reported a higher mean achievement gain in students taught Biology with co-operative learning strategy compared to the conventional method of teaching. This study also agrees with the finding of Igbanugo, (2013) who reported that cooperative learning is more effective in attracting students' interest to learning compared to conventional teaching. The relevance of this claim to the present study is that small group teaching strategy is a form of cooperative learning style (Cruickshank, 2003). The observed lower mean achievement gain of

students exposed to peer tutoring teaching strategy is not in agreement with the finding of Azubuike (2014). Azubuike whom investigated the Effects of Peer tutoring Instructional Strategy on Achievement in Biology of Secondary School Slow Learners in Anambra State revealed that students taught by peer tutors in the experimental group performed significantly better than those exposed to expository method. The findings of this study is also not in consonance with the findings of Hovarth (2011) that investigated on "Effect of Peer Tutoring on Student Achievement," using selected students in sixth grade classroom and reported peer tutoring as an effective instructional strategy, resulting in higher student achievement.

This study however agrees with the findings of Dill and Boykins (2000) who researched on the effect of communal learning peer tutoring and individual learning on the text recall of African American fifth grader and concluded from their results that communal learning students gained significantly more on recall of or retention on text than peer tutoring and individual learning participants. The possible explanation for this trend had been previously reported by Solomon and Crowe (2001) who examined a peer tutoring model from the perspective of the student tutor and reported that most students struggled with basic facilitation skills and had difficulty in separating the role of student from that of tutors.

Findings of this study also reported the significant impact of sex on mean achievement gain of students exposed to small group teaching strategies and peer tutoring strategies. In both strategies it was observed that the female students always had higher mean achievement gain but not significant since this study revealed there is no significance.

This finding is not in agreement with the findings of Dania, (2014) who reported a non significant main effect of sex on student's achievement in social studies. Also not in

corroboration with the findings of Nnorum, (2015) who reported a non significant interaction of sex in Biology achievement of students taught with co-operative learning and the conventional method of teaching. Although there was a significant difference relative to teaching methods and sex, findings made in this study revealed no significant interaction of sex and teaching strategies on students' achievement and agrees with Nnorum, (2015) but disagrees with Dania (2015) who reported a significant interaction of sex and teaching methods. The implication of the present findings is that the influence of teaching methods on students' achievement occurs independent of the students' sex.

The finding relative to students' retention scores showed that the highest retention score was obtained by those exposed to lecture method with a mean score of 2.55 followed by those exposed to small group with a mean score of 2.01 and the peer tutoring group with 1.68 and did not show any significant difference among the three groups. Retention in learning has been defined as having the information stored in long-***term*** memory in such a way that it can be readily retrieved (Bennet & Rebello, 2012). It is also said to be influenced by a lot of factors which includes but are not limited to the teachers' experience, conditions of learning and personal efforts made by the learner. The higher retention scores achieved by those in the lecture method may be explained with Bennet and Rebello (2012), statement, as they aptly put it that varied learning conditions pay high dividends for the effort exerted and that when learning occurs under varied conditions, key ideas have "multiple retrieval cues" and thus are more "available" in memory.

In another development, Owodunmi and Ogundolla, (2013) reports that students retention capacities is mostly dependent on the extent of involvement of those students in what learn is

learnt and that it is only an initial and genuine investment in the hard work of learning that specific difficult concepts seems automatically familiar and easy to recall.

The assertion is not in agreement with this research finding and this cannot be justified since a higher retention score in this study was by students exposed to lecture method, followed by those exposed to small group strategies. In the same line, findings from this study are in exact opposite with the assertion of Eze and Egbo (2007) whose reports revealed that students exposed to student-centered methods retained better than those taught with the traditional lecture method.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter summarized the research study, drew conclusions based on the findings and put forward appropriate recommendations to improve the teaching and learning of Biology in Secondary Schools.

Summary of the Research

The major purpose of this research work was to investigate the effect of Small group and Peer tutoring teaching strategies on students' achievement and retention in secondary school Biology in Delta State.

The major significance of this study is that Biology teachers in secondary schools may make use of the findings to redirect their teaching and also equip them with skills on Small Group and Peer Tutoring teaching strategies. This study will also be beneficial to the Biology students, Biology curriculum planners and even the Ministry of Education.

In this study 12 research questions and 12 null hypotheses were generated, formulated and tested at 0.05 level of significance. Review of related literature was carried out under sub headings. The scope of this research work covered topic on Sense organs, Reproduction in animals and Reproduction in plants. This work was designed for all public Secondary School II (SS II) Biology students in Delta State. The focus of this research work is to examine the effects of Small Group and Peer Tutoring teaching strategies on student achievement and retention in secondary school Biology. This study will also compare the achievement and retention of Biology students that will be exposed to Small Group and Peer Tutoring teaching strategies.

This research work employed a pre-test, post-test, control group quasi experimental (2 x 3 x 3) factorial design. This design employs intact classes for all groups involved both experimental and control groups, so as to ensure non-alteration of regular class periods and allow maximum control variables. This design also justified the randomly selected public secondary schools that were picked for the study. This design consisted of three instructional groups

d. Experimental group I (Small Group Teaching).

e. Experimental group II (Peer Tutoring Strategy)

f. Control group (Lecture Method).

The population of this research work comprised all senior secondary class II (SS II) Biology students in all public secondary schools from the 3 Senatorial Districts of Delta State. There are thirty thousand, eight hundred and thirteen (30,813) senior secondary II (SS II) Biology students and four hundred and thirty six (436) public secondary schools, in the three (3) senatorial districts of Delta State.

The purposive and random sampling techniques were employed in the study at various stages. The sample size of this work was six (6) public secondary schools from the four hundred and thirty six (436) Secondary Schools in Delta State, six (6) intact classes of Senior Secondary II students from the six (6) chosen Schools, Two hundred and thirty nine (238) senior Secondary II students, (135 males and 103 females), six (6) research assistants from the six (6) selected public Schools.

This study used one (1) research instrument and three different lesson plans (Instructional package). The research instrument is called Students' Biology Achievement Test (SBAT). This Students' Biology Achievement Test (SBAT) was developed by a selection and compilation of

test items on the topics of Sense Organs, Reproduction in Animals and Reproduction in Plants drawn from 2010- 2014 West Africa Certificate Examination (WASSCE) and National Examination Council (NECO) question papers.

The three different lesson plans (instructional packages) were comprehensive lesson plans drawn from some topics (Sense Organs, Reproduction in Animals and Plants) for senior secondary II (SSII) were instructed using Small Group strategy, Peer Tutoring and Lecture Method respectively for six (6) weeks.

The Students Biology Achievement Test (SBAT) together with a criteria validation form and three lesson plans (instructional package), was given to three (3) experts in Biology Education, Curriculum Studies and Measurement and Evaluation Departments to make inputs on the face and content validities. At the end, 30 test items were used out of the original 40 test items

The reliability of the research instrument called Students Biology Achievement Test (SBAT) was determined using Kuder-Richardson 21. Reliability coefficient of 0.81 for Student Biology Achievement Test (SBAT) was obtained. All subjects were pre-tested before treatment.

Two Biology teachers from each school which served as instructors and research assistants were initially trained and used to present the content materials to the students. At the end of the training, the instructors were given copies of the instructional packages comprising of six weeks instructional unit, a comprehensive lesson plan to be taught and instructional materials. The intact classes were randomly assigned into experimental and control group through balloting using the replacement and withdrawal technique.

The treatment lasted for six weeks. At the commencement of the treatment, students in experimental group one (1) were instructed using Small Group strategy, while students in experimental group two (2) were instructed using Peer Tutoring strategy and Lecture Method was used in the control group. At the end of the treatment, post achievement test scores for students were collected. Four weeks later, the follow – up test (retention test) scores of students were also collected.

Mean and Standard Deviation was used in analyzing all the research questions while analysis of variance (ANOVA), Analysis of covariance (ANCOVA) and t-test were used in analyzing the hypotheses. Also post-hoc multiple comparisons was done using Bonferroni test to indicate the direction of the significant differences. The results indicated that students taught Biology using Small Group strategy achieved higher that those taught using Peer tutoring. The rate of retention was higher in Biology students instructed using lecture method. There was no significant interaction affect between instructional strategies and sex. Since results of the study showed that Small Group teaching strategy positively influenced higher achievement and retention. It can be concluded that Small Group teaching strategy will be a suitable method for teaching Biology in secondary schools. The findings therefore recommends that Biology teachers should be more innovative and incorporate Small Group teaching in their mode of instructions in Biology lessons in secondary schools.

Findings

1. There was significant difference in the mean achievement test scores among Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method.
2. The difference in the mean achievement test scores of male Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method was significant.
3. There was significant difference in the mean achievement test scores of female Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method.
4. Female Biology students achieved significantly better than the male students in the small group teaching strategy.
5. There was no significant difference between the mean achievement scores of male and female Biology students exposed to peer tutoring strategy.
6. There was no significant interaction between teaching strategies and sex on student's achievement in Biology.
7. There was no significant difference in the mean retention test score of Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method.
8. There was no significant difference in the retention test scores of male Biology students exposed to small group teaching, peer tutoring strategy and lecture method.
9. There was no significant difference in the mean retention test score of female Biology students exposed to small group teaching strategy, peer tutoring strategy and lecture method.
10. The difference between mean retention test scores of male and female Biology students exposed to small group teaching strategy was not significant.
11. There was no significant difference between the mean retention test scores of male and female Biology students exposed to peer tutoring strategy.

12. There was no significant interaction effect between teaching strategies and sex in students retention in Biology.

Conclusions

Based on the research findings, the researcher came up with the following conclusions.

1. There was significant difference in the mean achievement test score among Biology students exposed to Small group, peer tutoring and lecture method. Results revealed that students in Small group strategy achieved significantly higher than those exposed to peer tutoring strategy.
2. The achievement of Biology students exposed to Small group and peer tutoring teaching strategies depend on the student sex in favour of females. Conclusively therefore, student sex was a variable.
3. There was no significant interaction between teaching strategies and sex on biology student's achievement.
4. There was no significant interaction between teaching strategies and sex on student's retention in Biology. Conclusively on retention, students exposed to lecture method retained higher than students exposed to Small group and peer tutoring after a few weeks (4 weeks)
5. Finally, the retention in Biology students exposed to Small group and peer tutoring strategies did not depend on student sex: this implies from the findings that sex was actually not a variable in student's retention in biology.

Conclusively, therefore, on the findings of the study since one major objective of science teaching is to enhance students' effective learning ad proper understanding, it is obvious that the Small group teaching strategy is a better teaching strategy for teaching and learning Biology in

secondary school. Since it was effective on students' achievement and also effective in retention abilities of the students. The lecture method can still be used to teach secondary school Biology since findings from the research showed that students retained materials better when exposed to it after a period of time (4 weeks).

Contributions to Knowledge

1. The study has established that small group strategy is a more effective teaching method than Peer tutoring strategy and the lecture method.
2. This study has helped generate rich data for comparing effectiveness of theses teaching strategies (Small group, Peer tutoring and Lecture method) with the intention of recommending the most effective for the teaching of Biology in secondary Schools.
3. This study has shown how the variable of sex determined the extent to which student's in Small group and Peer tutoring teaching strategies was influenced.
4. This study has provided data to be added to the volume of literature on Small group and Peer tutoring teaching strategies on good instructional strategies.
5. This study has shown that there was no interaction effect of teaching strategies and sex in student's achievement and retention.

Recommendations

Based on the major finding of this study the following recommendation is offered;

1. Teachers should expose Biology students to small group teaching strategy so as to promote effective and active learning, motivation and learning by experience among students.

2. The teacher education programme in Nigeria tertiary institution should be enhanced to prepare teachers who can apply innovative and students centered approaches (small group teaching) that will promote effective teaching and learning.

3. Science educators, curriculum planners and teachers should recognize co-operative and collaboration teaching strategies on more innovative, student centered and result oriented pedagogical approaches in teaching Biology.

4. Secondary school Biology science teachers should be trained through intensive seminar workshops and in-service training on the use of small grouping teaching and learning of Biology

Suggestions for Further Research

- There is the urgent need to replicate a further study in other science subjects area
- There is need to redesign a teaching strategy using Small group with a pedagogical design that will focus on complex talks.
- There is the need to replicate the study using larger sample sizes.
- This study should equally be carried out and compared with other co-operative and collaborative strategies of teaching.

REFERENCES

Abimbola, I.O. (2013). The misunderstanding word in science towards a technology of perfect understanding in all, 123rd inaugural lecture of university of Ilorin (022- 31) Unillorin press.

Abrami, P.C, Poulsen, C & Chambers, B (2004). "Teacher motivation to implement an educational innovation: factors differentiating users and non-users of cooperative learning". Educational psychology: *An International Journal of Experimental Educational Psychology, 24 (2) 201 – 216.*

Adekoya, Y.M & Olatoye, R.A. (2011). Effect of demonstration, peer-torturing and lecture teaching strategies on senior secondary school students' achievement in an aspect of agricultural science. *The Pacific Journal of Science and Technology* 12 (1) 320-332.

Adunola, O. (2011). The impact of teachers' teaching methods on the academic performance of primary school pupils in Ijebu-ode local Government Area of Ogun State ego Booster Books.

Ahmed, M.A (2008). Influence of personality factors on Biology lecturer's assessment of difficulty levels of genetics concepts in Nigeria colleges of education.

Ahmed, M.A. & Abimbola, I.O. (2011). Influence of teaching experience and school location on Biology teachers rating of the difficult level of nutrition concepts in Ilorin, Nigeria *JOSTMED 7 (2), 52 – 61.*

Ajaja, O.P & Ochonogor, E.C. (2005). *Teaching Methods: A mult-disciplinary Approach*, Lagos: Oludare Obielum Printing Nigeria enterprise.

Ajaja, O.P (2007). *Teaching Methods across Disciplines*. Ibadan. BOMAN print.

Ajaja, O.P (2013). Which strategy best suits Biology teaching? Lecturing, concept mapping, cooperative learning or learning cycle? *Electronic Journal of Science Education* (Southwestern University). 1 (17), 1 – 37

Akanbi, A.A. & Kolawole, C.B (2014), Effects of guided-discovery and self learning strategies on senior secondary school students? Achievement in Biology; *Journal of Education and Leadership Development*. *6 (I), 9 – 40.*

Akinsola, M.K. (2002). Instructional methods, employed by Mathematics Teacher. A managerial approach, *African Journal of Educational Planning and Policy Studies* 3 (1), 25-32.

Al-Hajaya, N & Al-Kresbeh, T. (2012). The Effects of cognitive learning style-based reading programme of the achievement of Jordanian Freshman English majors *International Education Studies* 5 (3), 235 – 246.

Allen J. P (2011) Effects of a teacher Professional Development Intervention on Peer Relationship in Secondary classrooms. Science in peer 40(3) 367-385.

Ames, C. (1992). Classrooms; goals, structure and student's motivation. *Journal of Education Psychology*, 84(3) 261-271. Doilo.1037/0022- 0663.84.3.261.

Arisi, R.O. (2004). Effects of instructional methods and cognitive style as co-variates on students' academic achievement in junior secondary social studies. *Journal of Educational Research and Development,* 3(1) 209-221.

Asaju (2014). Effect of pre-theoretic intuition quiz constructivist strategy on students' achievement in environment-related concept in Biology: IOSR *Journal of Research & Method in Education* (IOSR – YRME) 44 – 56.

Ayodele, A. (2002). Obstacle to effective teaching and learning of chemistry at the secondary school level: *Curriculum Implication for Sustainable Educational Development*. Proceedings of the 43rd annual conference and inaugural conference of cast time African, 2002 P. 539-542.

Azubuike, E.N (2014). Effects of Peer Tutoring instructional strategies on achievement in Biology of senior secondary school slow learners.

Bahar, M. (2003). The effects of instructional methods on the performance of the students having different cognitive style. *Journal of Education* 24(3), 26 – 32.

Balogun, A.A. (2002). Dorminal methods of teaching Nigerians schools. *Journal of Education* 6. (1).

Bennett, J. (2003). *Teaching and Learning Science*. London: continuum.

Biswas, G & Leclawong, (2007) *Pedagogically agent for Learning and Teaching*; teachable agents, Educational technology, 47(i) 56-61.

Borish, G. (2003). *Observation skills for effective teaching* (4th ed) Upper River, nj merill/ prentice hall.

Bowman – Periott, L., Davis, H., Vannest, K., Willains, L., greenwood, C., Parker, R., (2013) Academic Benefit of peer tutoring: A meta – Analysis Review of single care Research School Psychologies Review, 42(1), 39 – 55

Briggs, J. & Tang, C (2007). *Teaching for Quality Learning at University*. New York: Mcgraw Hill.

Cakir, M. (2008). Constructivist approaches to learning in science and their implication for science pedagogy: *Internal Journal of Environmental and Science Education*. 3(4), 193 – 206.

Chen, H.L (2008). *Conceptualizing Engagement*: contribution of faculty to student engagement in engineering j. eng. educ. 97(2), 339-353.

Chinason, M.M. et al (2010). Cooperative learning in kurumeh, m.s and opala, m.f. (eds), *Innovative teaching approaches of mathematics education in the 21st century* 1: 27- 40 Markurd, Nigeria, Azaben press.

Chukwu, C.E, (2011). Effect integrated model of teaching on student's retention in Biology. *Nigeria Journals of Research and Production* 18(1), 1 – 8.

Chuska, K. (1995). *Improvising classroom questions*, a teacher's guide to increasing student motivation, participation and higher-level thinking Bloomington, in: phi delta kappa educational foundation.

Chinason, M.M, Kurumeh, M.S & Obida, J.A (2010). Effect of cooperative learning strategy on students' retention in circle geometry in secondary schools in Benue State, Nigeria. American journal of scientific and industrial research 2 (1), 33 – 36.

Cohen, E. (1994). Restricting the classroom conditions for productive small group. *Preview of Educational Research* 64 (1), 1-35.

Cohen, P.A; Kulik, J.A; Kulik C.C. (1982). *Educational outcome of tutoring*: a meta- analysis of finding *American Educational Journal* 19.2237-248.

Cooke, N. L, Heron, T. E & Herried, W. L. (1983) Peer tutoring: implementing class wide program in primary grades. Columbus, O. H; Special Press.

Cornellus White, J. (2007). *Learner-Centered Teachers Student Relationships are Effective*: A meta-analysis. *Review of Educational Research*, 77(1), 113-143.

Cruickshank, D. (2003). *The act of Teaching*: (3rd ed) Boston: Mcgraw-Hill.

Dame, N. F (2012): "The role of frequency a cross-ability peer tutoring on students performance in a collegiate, Development mathematics classroom" Dissertation, school of Education, Colorado State University. Fort Collins, Colorado.

Damon, W. (1995). *Peer relations and learning in international encyclopedia of teaching education*. Edited by L.W Anderson, Cambridge University Press, UK. 337-38.

Dania, P. O. (2014). Effect of gender on students academic achievement in secondary school socials studies. *Journal of Education and practice* 5(21) 78-84.

Davis, R.B. (1997). *Alternative learning Environment Journal of Mathematics Behaviour*, 16 (2); 87-93.

Deci, E.L. & Ryan, R.M. (1980). *Intrinsic Motivation and self-determination in Behavior*. New York, NY. Plenum Press.

DewinStamley, PA, and Bjork. RA (2002) Successful lecturing: Presenting information in ways that engage effective processing. New Direction for teaching and learning, No. 89 San Francisco: Joscey-Bass, P. 19-31

Dill, E.M & Boykins, A.W (2000). The comparative influence of individual, Peer Tutoring and communal learning: *Journal of Black Psychology*, 26 n (i) 65-78.

Dixons & Gudons (2000). The impact of peer Assister Learning on Student Performance and Retention Michigar Community College Journal: Research & Practice 6(2), p95-99.

Edegoke, (2014). Effect of pre-theoretic intuition quiz contructivist strategy on students' achievement in environment-related concept in Biology: IOSR *Journal of Research & Method in Education* (IOSR – YRME) PR 44 – 56.

Eze, A. E. & Egbo, J. J. (2009). Effects of concept mapping method of instruction on students achievement and retention in chemistry. *Nigeria journal of functional education* 5(1). Nsukka. Ephrata Press production.

Ezenwosu, S.U. & Nworgu, L.N. (2013). Efficacy of Peer Tutoring and sex on student's achievement in Biology. *International Journal of Scientific and Engineering Research*. 4 (12), 944-950.

Fabunmi, M. (2004). *The role of sex in secondary school students academic performance* in Edo State, Nigeria, *West African Journal of Education* 24(1), 90-93.

Falk, K. B. & Wehby, J. H. (2001). The effect of peer assisted learning strategies on the beginning reading skills of formal children with emotional or behavioural disorders: Behavioural Disorders, 26, 344-354.

Federal Republic of Nigeria (1977). *Nigeria National Policy on Education (revised)* Yaba, Lagos NERDC press.

Federal Republic of Nigeria (1981). *Nigeria National policy on education (revised)* Yaba, Lagos NERDC press.

Federal Republic of Nigeria (1998). *Nigeria National policy on education (revised)* Yaba, Lagos NERDC press.

Federal Republic of Nigeria (2004). *Nigeria National Policy on Education (revised)* Yaba, Lagos NERDC press.

Federal Republic of Nigeria (2004). *Nigeria National Policy on Education.* Lagos NERDC press.

Federal Republic of Nigeria (2007). *Nigeria National policy on education (revised)* Yaba, Lagos NERDC press.

Federal Republic of Nigeria (2013). *Nigeria National Policy on Education (revised)* Yaba, Lagos NERDC press.

Ford, N & Chen, S.Y. (2001). Matching/Mismatching revisited; an empirical study of learning and federal republic of Nigeria (2004), styles: *British Journal of Educational Technology*, 32 (1), 5 - 22.

Gambari, A.I (2014). Improving secondary school students' achievement and retention in Biology through video-based multimedia instruction insight: *Journal of Scholarly Teaching*. P. 75 – 91.

Gana, (2014). Improving secondary school students' achievement and retention in Biology through video-based multimedia instruction insight: *Journal of Scholarly Teaching*. P. 75 – 91.

Gibson, J (2010). *Small Group Federal Republic of Nigeria* (2004), And English literature: A good practice gunde. higher education academy report series N. 23 Nov. 2010.

Golding, S. Lisa, F. & Tenant E. (2006) *Effects of Peer Tutoring attitude and personality on academic performance of first year introductory programme students*. Jamaica: Taylor and Francis ltd.

Gustello, S., Liebovitch, L. (2009). Introduction to nonlinear dynamics and complexity. In S. Guestello, M. Koopmans and D. Pincus (eds), *Chaos and complexity In psychology. The Theory of Non-linear Dynamics Systems*: New York: Routledge.

Halpem D, Hackel M. D et. al (2003) *Applying the science of learning to the University and beyond*. Teaching for long term retention and transfer. Change July/August 2003, P.36-41

Hattie, J. (2009). *Visible learning, a synthesis of over 800 meta-analyses relating to achievement*, New York: Routledge.

Herried, C.F. (1998). Team learning: co-operative learning in the science classroom: national centre for case study teaching in science, University at Buffalo, State University of New York.

Hesson, M. & Shad K.F. (2007). A student-centered learning model, *American Journal of Applied Sciences* 628-636.

Hornby A.J., (2000). Oxford Advanced learners dictionary. Oxford University Press.

Hornby, A.S. (2006). Oxford learners dictionary of current English, London: Oxford university press

Horvath, K (2011). Effects of Peer Tutoring on students achievement. M.ed research work, university of Ohio, Ohio.

Huitts, W. (2003). A Transactional model of the teaching learning process. Education psychology interactive, Valdosta GA Valdosta State University.

Igbanugo, B.I (2013). Effects of peer teaching on students achievement and interest in difficult chemistry concepts international: Journal of education research 72 (2) 61-71.

Imo, U.A. Uwandu, V.N. & Ekanem, I.M. (2013). Co-operative effects of Small Group and teaching method on students' academic performance in Biology. *International Journal of Applied Sciences and Engineering Research*, 2,(4).

Inomiesa, E.A. & Unuero, J.U (2003): Concept mapping, a radical paragon to guided-discovery method in the teaching of science in Nigeria. *Journal of Educational Research and Development, 2(i): III-II9*.

Institute For Learning And Technology (2015). Inclusive teaching, the University of Sdney, viewed january, 2015.

Jack, A.N & Johannes. R. (2001). Sex difference in planning, attention, simultaneous and successive (PASS) cognitive process and achievement. *Journal of Educational Psychology*.

Jaques, D. (2000). *Small Group teaching*, oxford centre for staff and learning development, U.K.

Jibrin, A.G & Zayum, S.D, (2012). Effects of Peer Tutoring instructional method on the academic achievement in Biology among secondary school students in Zaria metropolis: Journal or Research in education and society: 3 (2) pp 13-17.

Johnson, D.W. Johnson, R. & Holubec, E.J. (1994). The new circle of learning senior secondary school students performance in Biology in Ilorin, Nigeria.

Kareem, L.O. (2005). Effects of audio-graphic self-instructional packages on senior secondary school students performance in Biology in Ilorin, Nigeria. Unpublished PhD thesis of the University of Ilorin, Ilorin.

Kirkham, R & Ringlestein, D. (2008). Student peer assisted mentoring (SPAM): a conceptual framework: *e-Journal of Business Education and Scholarship of Teaching*, (2); 39-49.

Klieme, E. et al (2009). The Pythagoras study- investigating effects of teaching and learning in Swiss and German mathematics classroom. In T., Janik & T., Seidel (eds),

*The Power of Video Studies in Investigating Teaching and Learning in the Classroom. (*137-160) munster: waxmann.

Kundo, C.L. & Tutoo, N.N. (2002). *Educational Psychology* New Dehil: sterling publishers.

Kurumeh M.S., Onah F.O & Mohammed, A. S (2012). Improving students retention in Junior secondary school statistic. Greener journal of educational research 2(3). Pp 054-062.

Lindquist, T.M. (1995) Traditional versus contemporary goals and methods in accounting education bridging the gap with co-operative learning. *Journal of Education for Business*, 70 (5) 278-284.

Lipowsky, F. Rakoczy, K. Pauli, C. Drolinger-Vetter, B. Klieme, E. & Reusser, K. (2009). Quality of geometry instruction and its sdhort-term impact on students understanding of the Pythagoream theorem. learning and instruction 19 527-537.

Lumpe, A.T, (1995). Peer Interaction in Science Concept development and problems solving scho. Sci Maths 95.302.

Maheady, L. (2001). Peer mediated instruction and intervention and students with mild disabilities. *Remedial and Special Education,* 22(i) 4-15.

Mahshad, T. (2014), The Role of teacher in post method Eva express an *International Journal of Multi Disciplinary Research, no. 1.*

Mari J.S (2008). The Role of teaches on implantation of chemistry Curriculum. Proceeding of the 49th annual conference of stan p. 153-156.

Marzano, R. Picking, J. & Pollock, J. (2001). *Classroom instruction that words*: research-based strategies for increasing students achievement. Alexandria, V.A association for supervision and curriculum development.

Mbajirogu, N.M (2002). *Effects of science technology*, society approaches on scientific literacy and achievement in Biology Unpublished Doctorial Thesis. University of Nigeria, Nsukka.

Mc. Laughlin, M. Mc. Grath, D.J. Burian-Fitzgerald, M.A Lanahan, L. Scotchomer, M. Enyearnt, C. & Salganik, L. (2005). Students content engagement as a construct for the measurement of effective classroom instruction and teacher knowledge. Paper presented at the annual meeting of American educational recorders association montreal, Canada.

Mckeachie, W. (1999). Teaching tips; strategies, research and theory of college and university teachers (10th Ed) Houghton, Mifflin, boston, M.A. USA pp 16.

Mehra, V. & Rathee, N. (2004). Effect of inquiry training model and mastering learning model on achievement and retention in Mathematics of class v students. Recent recorders in education and psychology 9(III-IV), 50-62.

Mickelson et al (2003). Reciprocal peer tutoring; an embedded assessment technique to improve student learning and achievement present at the annual meeting of the American education research association Chicago. IL

Miller, L. (1993). Winning with peer tutoring, preventing school failure, 337(3), 14-9.

Moll, I. (1994). Reclaiming the natural line in Vgotsky's theory of cognitive development Human Development. 643.

Moore, R; (2000). For knowledge: traditional, progressivism, and progress in education restructuring the curriculum debate: *Cambridge Journal of Education* 30 (1) pp 17-35.

Morgan, S. L. (2005). On the edge of commitment: educational attainment and race in the United States, Stanaford, CA: Stanford University Press.

Nazzal, A.K (2000). Peer Tutoring and at risk students; the effect of Peer Tutoring on attendance rates, misbehavior in school and academic progress for student's identified as at risk for dropping out of high school *Dissertation Abstracts International*. A-61/02.483.

Newton A, et al, (1994). Statistics and stories; in mentoring a resource and training guide for educators, regional laboratory for educational improvement, Andover, M.A.

Njoku, Z.C (2007). Engineering learning equity in science and technology classrooms for sustainable Development. Proceeding of the 50th annual conference of STAN. p 24-31.

Nnorom, N. R. (2015). Effect of cooperative learning instructional strategy on senior secondary school students' achievement in Biology. *International journal for cross disciplinary subjects in education* 5(1) 2424-2427.

Nnorom, N.R (2005). Effect of cooperative learning instructional strategy on senior secondary school students achievement in Biology in Anambra state International journal for cross disciplinary subject in education 5(1) 2424 – 2427.

Nwagbo, C & Chikalu, U.C., (2011). Effects of Biology practice activities on students process skill acquisition. *Journal of Science Teacher Association of Nigeria.* 46 (1) 58-70.

Nwagbo, C.R. (2009). *Science technology and mathematics (STM) curriculum development:* focus on problems and prospects of Biology curriculum delivery. 49th annual conference proceeding of science teachers association of Nigeria.

Nworgu, B.G. (2006). *Educational research: basic issues and methodology* (2nd Ed). Enugu: university trust publishers.

Nworgu, L.N (2013). *Improving Secondary School Biology teachers' ridagogic content knowledge within a constructist Framework: International Journal of Asian Social Science, AESS Publication 12375-2381.*

Nworgu, L.N. (2009). *Fundamental principles and methods of teaching Biology*; Enugu: global publishers (Nig) Ltd.

Ogbu, C.E (2005). *The relative effectiveness of guided inquiry expository instructional method on students' achievement*, Unpublished M, Sc dissertation. Enugu state University of Science and Technology Enugu.

Oghenewevde, O.E. (2010). Effects of discovery and inquiry approaches in teaching and learning of Biology in secondary schools students' performance in Delta State: *Journal of Research in Education and Society*, 1 n (i).

Ogundiwin, O.A. (2014). Effect of pre-theoretic intuition quiz constructivist strategy on students' achievement in environment-related concept in Biology: IOSR *journal of research & method in education* (IOSR – YRME) PR 44 – 56.

Okafor, E.N & Okeke, SO.C (2006). *Concept mapping as an effective technique for teaching difficult concepts in Biology*, 47th annual conference proceeding of STAN Pp. 122-127.

Okebukola, P.A. (1984), Co-Operative and individualistic sciences laboratory interaction patterns, effects on students' achievement and acquisition of practical skills. *Journal of Education Research*, 85 (5) 261-273.

Okoye, N. S (2007): Theory and practice of curriculum development for Nigeria Students, Abraka: Delsu Investment Ltd.

Okoye, P. O (2014). Influence of cognitive styles on students achievement in biology in senior secondary schools in Anambra State *International journal of science and technology* 3 (1) 198-207.

Olarinoye, R.D. (2001). Science Education as a basic for technological development. a lead paper presented as 1st national conference of federal college of education (Technical) Gombe, Gombe State.

Olatoye, R.A & Adekoya, Y.M (2010). Effects of project based, demonstration and lecture teaching strategies our senior secondary students achievement in an aspect of Agricultural science; international formal of educational research and technology 1(1) 19 -29.

Oludipe & Bimbola, D (2014). Cognitive style profile and physics of senior secondary school students in Ogun state, *Nigeria Journal of Education and Practice*. 5.

Oluyemi, A. Ogundiwin, Adegoke, Idowu, (2014). Effects of pre-theoretic intuition quiz constructivist strategy on students achievement in environmental related in Biology. *Journal of Research and Methods in Education*. 10SR. (4) 46-56.

Onwuakpa, F.I. & Nweke, A.O. (2003). Enriching science technology and mathematics education in secondary schools through effective utilization of resources in the classroom. 41st annual conference proceedings of STAN, p. 34-37.

Orlich, D.C; Harder, R.J; Callahan, R.C. & Gibson, H.W. (1998). *Teaching strategies*, 5th Edu Boston, ma, Houghton Mifflin.

Otuka, J.R. (2006). The teacher as a key to national development and technological breakthrough a lead paper presented at a National conference organized by school of science, federal college of education, Caria Kaduna State. 4th – 7th April.

Oyovwi, E.O (2012). *Effects of concept mapping and inquiry method, in teaching difficult topics in Biology on students academic achievement*: An Unpublished Ph.D thesis, DELSU Abraka.

Pellegrino, J.W. Chudowsky, N & Glaser, R. (2001). Knowing what students know; the science and design of assessment, Washington, D.C national academy press. Peter, O.D. (2014). *Effects of sex on student's academic achievement in secondary school social studies. Journal of Education and Practice*. (5) no. 21. *Proceedings of the 45th annual conference of stan. 135-140.*

Popham, J. W (2005) *Classroom assessment:* What teachers need to know (4th ed). Boston Pearson, Allyn and Bacon.

Post Primary Education Board, Asaba (PPEB, 2015)

Ramsden P. (2003), Learning to Teach in University, London: Rotledge Farmer.

Razia, R. (2012). *The effect of Peer Tutoring on students' achievement* in the subject of English at secondary level in the light of Vygotsky Theory. Ph.D thesis Islamabad, Paskistan.

Reeve (2002) Instructional Management: TIMSS & PIRLS: International Study Centre, Lynch School of Education Boston College: 78 – 79 TIMSS 2015 retrieved on January 19, 2007.

Richards, J.C. & Farrel, T. (2005). Professional development for language teachers, Cambridge cup.

Rohrbeck, C.A. Ginsburg-block, M.D. Fantuzzo, J.W. Miller, T.R. (2003) Peer assisted learning interaction with elementary students: a meta-analytic review *Journal of Educational Psychology*. 95:77-89.

Romano, P. & Walker, J. (2010). Bio buddles: Peer Tutoring instructional strategy, NERAS conference proceeding, paper 3.http:/digitalcommons.uconn.edu/near.

Roseline, B. Meister, C & Chappman, S (1996). Teaching student to generate questions: a review of intervention studies. *Review of Educational Research*, 66, 181-221.

Ryan & Deci (2000) Instructional Management: TIMSS & PIRLS: International Study Centre, Lynch School of Education Boston College: 78 – 79 TIMSS 2015

Sarah, A.S (2009). Peer Tutoring as an effective instructional strategy to promote a collaborative environment with learning as a social press to enhance reading achievement: student as

teachers, teachers as facilitators: published them for a degree of education apeaulist in education at northern Michigan university.

Savery, J.R. & Duffy, T.M (2001). Problem based learning: an instructional model and its construction frame work retrieved July 28, 2009, from the center for research on learning and technology.

Schein, E.H & Bennis, W.G. (1965). Personal and organizational change through group method Schleyer, G. K. (2005) Peer tutoring in conceptual design. *European journal of Engineering Education* 30 (2). 245 – 254

Schleyer, G. K. (2005) Peer tutoring in conceptual design. *European journal of Engineering Education* 30 (2). 245 – 254

Shapiro, N & Levine, j (1999). Creating learning communities: A practical guide tutoring support, organizing for change and implementing programme. San Francisco, Jossey-Bak.

Shernoff, D. J., Csikszentmihalyi, M. Schneider, B. S & Shernoff, E. S. (2003). Student engagement in high school classroom from the perspective of flow theory. *School psychology Quarterly*. 18(2), 158-176.

Solomon, P. & Crowe, J. (2001). Perception of student, peer tutors in a problem-based learning programme. *Medical education* 23, 181-186.

Solomon, R. O (2004). Sex differences and student achievement in secondary school Biology In Tinajero, C and Paramo, M.F. (eds). Field-dependent Independence academic achievement. a review of research and theory. *European Journal of Psychology of Education*.

Starr, S. A. (2009). Peer tutoring as an effective instructional strategies to promote a collaborative environment with learning as a social process to enhance reading achievement: *student as Teachers, Teachers as facilitators*. Published thesis education specialist in education Northern Michigha Univeristy.

Sternberg, R.T & William, W.M. Educational Psychology, Boston M.A: Allyn and Bacon. the laboratory approach. New York: John Wiley.

Stronge J. H, Grant, C. R & Ward, G. L (2011) Instructional Management: TIMSS & PIRLS: International Study Centre, Lynch School of Education Boston College: 77 – 79 TIMSS 2015

Tella, A. (2008). Relationship among demographic variables and pupils reasoning ability. *Electronic Journal of Research in Educational Psychology* 6(3), 709-728.

Tella, A. (2013). The effects of Peer Tutoring and explicit in structural strategies on primary school pupil learning outcome in Mathematics. Bulgarian journal of science and education policy (BJSEP) 7 n (i).

Tiwari, M. (2014). Peer tutoring: *a step forward towards inclusion*. educations confab. ISSN: 2320-009X Tomlinson, C.A (2002) invitation to learn, educational leadership 60 (1), 6-11.

Topping K.J., & Bryce, A. (2004), Cross age Peer Tutoring of reading and thinking influence on thinking: influence of thinking skills, Educational Psychology, 24(5) 595 – 621.

Topping, K., Miller, D., Thurston, A., McGavock, K., Conlin, N., (2011) Peer tutor in reading in Scotland: thinking bog Literacy, 45 (1), 3-9

Topping, K.J (2001). *Peer-assisted learning*: A Practical Guide for Teachers, Cambridge, M.A: Brooklyn books.

Topping, K.J (2005). Trends in peer learning *Educational psychology*. 25(6); 631-645.

Topping, K.J. (2003). Tutoring Peers, Family and Volunteers, General: And Cultural Organization (UNESCO).

Topping, K.J; & Elhy, S.W. (2001) Peer-assisted learning: a framework for consultation, *Journal of Education and Psychology Consultation*, 12 (2), 113 – 132.

Ughovwa, (2014). Improving secondary school students' achievement and retention in Biology through video-based multimedia instruction insight: *Journal of Scholarly Teaching*. 75 – 91.

Ukpene, A.O. (2004). Attitude of Biology teachers to research and research findings.

Umar, A.A. (2011). *Effects of Biology practical activities on students' process skill acquisition* in Minna, Niger state, Nigeria, *Jostmed*, 7 (2) 118-126.

Umoke, J.C & Nwafor, C.C (2014). Effects of instructional simulation of secondary school students' achievement in Biology: education and practice 5(19): 101 -110.

Vinto T. (1997) Classrooms as communities: Exploring the educational characters of students persistences: *Journal of higher Education 68(6) ; 53–599-623*

Vygotsky, L.S. (1978). *Minds in society: the development of higher psychological process*. (M. Cocle, V. John Steniner, S. Scribner and Sounerman, eds. Anditans).

WAEC (2000). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2001). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2002). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2003). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2004). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2005). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2006). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2007). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2008). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2009). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2010). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2011). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2012). *Chief examiner report, Biology,* Lagos, Nigeria.

WAEC (2013). *Chief examiner report, Biology,* Lagos, Nigeria.

Walberg H. J & Susan J. P (2000) *Effective educational practices*. Chicago International Academy of Education.

Walberg H. & Paik, S. (2000). Effective educational practices. Brussels, Belgium Academy of Education

Wehly, J.H & Falk, K.B (2003). The impact of comprehensive reading instruction on the academics and social behaviour of students with emotional behaviour disorder. *Journal of Emotional and Behavioral Disorder*. 11, 225 – 238.

Wood, W.B & Gentile, J.M. (2003). Teaching in a research context science, 302:1510.

Yair, G. (2000). Educational battlefields in America: The thug-of-war over students engagement with instruction. *Sociology of Education*, 73(4) 247-269.

Yaki, (2014). Improving secondary school students' achievement and retention in Biology through video-based multimedia instruction insight: *Journal of Scholarly Teaching.* P. 75 – 91.

Yaro, P.O. (2010). Class size and students mathematics achievement of senior secondary schools in South-Western Nigeria. *The Social Science Journal* (TSS), 5(2); 108-112.

APPENDIX I

Statistics For Entries And Results For May/June WASSCE Biology For 2002-2013

YEAR	TOTAL ENTRY NO. OF CANDIDATES	TOTAL SAT NO. OF CANDIDATES	CREDIT PASSES 1-6 CANDIDATES	PERCENTAGE (%) CANDIDATES PASSES
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	107,607	375,850	35.04
2006	1,170,522	1,152,045	559,853	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	33.89
2010	1,331,381	1,300,148	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	1,678,154	1,646,741	850,706	51.66

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

APPENDIX II

Students Biology Achievement Test

(SBAT)

SECTION A

INSTRUCTIONS: Answer all questions from this section mark (√) from the option A – E provided against each question.

TIME: 1 Hour

1. Ability of the human eye to focus images accurately on the retina is called

(A) Astigmatism [ ]

(B) Myopia [ ]

(C) Adjustment [ ]

(D) Accommodation [ ]

2. The cochlea is situated in…….

(A) Brain [ ]

(B) Outer ear [ ]

(C) Inner ear [ ]

(D) Middle ear [ ]

3. A person had an accident that affects the skill but not the nose and later lost the sense of smell. The accidents must have affect the

(A) Nose of extension [ ]

(B) Olfactory lobes of the brain [ ]

(C) Passage from the nose to the brain [ ]

(D) Part of the skull near the nose [ ]

4. Balancing is one of the functions of the

(A) Tongue [ ]

(B) Legs [ ]

(C) Hands [ ]

(D) Ear [ ]

5. Which of the following is responsible for the sensation of touch

(A) Hands [ ]

(B) Skin [ ]

(C) Ear [ ]

(D) Olfactory [ ]

6. Semi circular canals are found in the……..

(A) Ear [ ]

(B) Tongue [ ]

(C) Nose [ ]

(D) Skin [ ]

7. A boy drinks, a bottle of coke and complains of bitterness, obviously he has a problem with his……..

(A) Nose [ ]

(B) Taste buds [ ]

(C) Mouth [ ]

(D) Teeth [ ]

8. A girl is feeling very cold, this means her…….is functioning properly.

(A) Corsides in the skin [ ]

(B) Clothes [ ]

(C) Eye [ ]

(D) Cochlea [ ]

9. Myopia is a defect of the

(A) Ear [ ]

(B) Eye [ ]

(C) Tongue [ ]

(D) Skin [ ]

10. The outermost part of the mammalian ear is called

(A) Middle ear [ ]

(B) Eustachian tube [ ]

(C) Pinna [ ]

(D) Auditory cornal [ ]

11. Spermatozoa are the sex gamete for…….

(A) Female [ ]

(B) Old women [ ]

(C) Male [ ]

(D) Production [ ]

12. Which is not present in the female reproductive organ?

(A) Penis [ ]

(B) Oviduct [ ]

(C) Ovary [ ]

(D) Uterus [ ]

13. The release of one ova every month in female……

(A) Menstruation [ ]

(B) Ovulation [ ]

(C) Copulation [ ]

(D) Excretion [ ]

14. Organs called urino-sental in functions are because

(A) They serve as excretory and reproductory in function [ ]

(B) Circulatory and reproductively [ ]

(C) Excretory and respiratory [ ]

(D) Reproductory and sense organ [ ]

15. The process whereby the spermatozoa fuse with the ova to form a zygote is called……..

(A) Ovulation [ ]

(B) Reproduction [ ]

(C) Menstruation [ ]

(D) Fertilization [ ]

16. Fertilization occurs in……

(A) Ovary [ ]

(B) Testis [ ]

(C) Fallopian tube [ ]

(D) Womb [ ]

17. Which of the following undergoes incomplete metamorphosis……...

(A) Housefly [ ]

(B) Cockroach [ ]

(C) Butterfly [ ]

(D) Mosquito [ ]

18. Cockroaches lay and store their legs in structures called……

(A) Purse [ ]

(B) Cocoon [ ]

(C) Nymph [ ]

(D) Egg case [ ]

19. Throxine is important in the reproduction process in one of the following

(A) Housefly [ ]

(B) Man [ ]

(C) Toad [ ]

(D) Birds [ ]

20. Reproduction in toad is……..

(A) Internal [ ]

(B) External [ ]

(C) Bisexual [ ]

(D) Meta-sexual [ ]

21. Seasonal migration in a courtship behavior with

(A) Birds [ ]

(B) Reptile [ ]

(C) Amphibian [ ]

(D) Cockroaches [ ]

22. The male sex gamete in the flowering plant is

(A) Ovule [ ]

(B) Ovary [ ]

(C) Pollen grain [ ]

(D) Filament [ ]

23. The part of the flower that attracts pollinations is called

(A) Sepal [ ]

(B) Calyx [ ]

(C) Corolla [ ]

(D) Pedical [ ]

24. One of the following is a drupe

(A) Okra [ ]

(B) Orange [ ]

(C) Tomatoes [ ]

(D) Coconut [ ]

25. One of the following is disposed by explosive mechanism……

(A) Rubber [ ]

(B) Coconut [ ]

(C) Mango [ ]

(D) Maize [ ]

26. Ovule in the flower is contained in……

(A) Filament [ ]

(B) Anther [ ]

(C) Ovary [ ]

(D) Receptacle [ ]

27. An example of a dehiscent fruit is

(A) Crotalaria [ ]

(B) Tomatoes [ ]

(C) Mango [ ]

(D) Orange [ ]

28. In the flowering plants, fertilization would occur when…….

(A) The pollen grows downwards penetrating the style [ ]

(B) A pollen grains is transferred to the stigma [ ]

(C) One of the nuclei inside the pollen tube fused with the ovum [ ]

(D) The nucleus of the pollen tube divides [ ]

29. What is the function of the stigma

(A) Attraction of insects [ ]

(B) Secretion of nectar [ ]

(C) Production of the stigma [ ]

(D) Formation of fruit [ ]

30. Wind pollinated flowers usually have

(A) Rough pollen grain [ ]

(B) Stricky stamens [ ]

(C) Small and short stigma [ ]

(D) Long style [ ]

APPENDIX III

Lesson Plan For Experimental Group I

(Small Group Strategy)

Lesson Note: No 1

Group: Experimental Group

Subject: Biology

Class: SS II

Week: One

Duration: 80 Minutes (2 Periods, 40 Min each).

Average Age: 16 Years

Sex: Mixed

Topic: Sense Organs (Skin, Nose, Tongue)

Number of Groups: Six (6)

Population of Groups Seven (7)

Instructional Objectives (Cognitive): At the end of the week two, the students should be able to:

a. Define the term sense Organs.

b. Identify the skin, Nose and Tongue

c. Identify sensory Nerve endings associated with the skin, Nose and Tongue

d. Identify the parts of the brain associated with these sense organs

e. Identify the various functions of the skin, Nose and Tongue.

f. Make Diagrams of Skin, Nose and Tongue, well labeled.

Affective: The students will learn to work in small collaborative groups.

Instructional Materials: Chart showing the Skin, Nose and Tongue, Chalk, Chalkboard, Concise Biology, textbook by B.N Okoro.

Previous Knowledge: Students are already familiar with sense organs from J.S.S classes and were asked to read the topic up after the pre-test in week one.

Introduction: The teacher tells the student, about Small Group teaching method. The teacher then re-arranges the class-room, breaking the class into small groups of 7 in each. In each group, the teacher appoints a group leader, recorder, observer, summarizer and reporter to ensure the importance of every group member to their group.

Presentation/Procedures: The teacher now introduces the week's topic as sense organs. He asks each group specific questions based on their previous J.S.S class knowledge.

Small Group A: What are sense organs?

Small Group B: What organ in the body is used for seeing?

Small Group C: What organ is the body is used for breathing?

Small Group D: What Organ in the body is used for Smelling?

Small Group E: What Organ in the body is used for tasting?

Student Activity: Each Group provides answers to the questions and on collectively praised for current answers.

STEP II:

The teacher then gradually, step by step explains what sense organs are. He explains that sense organs one specific organs in the body with specific functions for the adaptation of organism to their environment. He explains that these specific functions and adaptations are those of mammals or man. He lists the five major sense organs in man and their functions as follows:

Eye	- - - -	Organ of sight
Ear	- - - -	Organ of hearings and Balancing
Nose	- - - -	Organs of Smell
Tongue	- - - -	Organ of taste
Skin	- - - - -	Organ of touch, Pain, Pressure and Perceptive (feeling)

STEP III

The teacher using a chart shows the students the structure of the nose, skin and tongue, since he will be discussing the three organs first. He shows the students in their various groups. The various parts of these sense organs and their functions and asks each groups to carefully

study the charts presented to their groups. He gives each group five minute(s) to study it carefully, while he moves from group too group supervising.

Students Activity: The students carefully and quietly study their charts in their various groups, taking notes of the various parts of the nose, skin and tongue.

STEP IV:

The teacher now asks the students, to focus on the main chart attached to the chalk board and pay attention. He then carefully explains to the student the various parts associated with the brain in carrying out their specific functions.

Student Activity: The students listen to the teacher attentively.

STEP V

The teacher now makes a large labeled diagram of the Skin, Nose and tongue on the chalk Board and instructs each group to try and draw these organs on plain sheet giving to each member of the group he gives them 10 minutes each group round each group to assist the students on how to make or draw diagrams and labeling.

Students Activity: All students begin to draw the diagrams from the charts in their various groups.

STEP IV

The teacher after the Ten (10) minutes asks the group leaders to collect various groups' drawings. The teacher then summarizes the lesson from the very beginning.

STEP V

The teacher then evaluates each group with different questions to see if the lesson was properly grasped, but before that he gives each group 10 Minutes to discuss the lesson amongst them emphasizing on the collective notes and collaborations. He then presents the group questions.

Small Group A: What Nerve ending is associated with smell?

Small Group B: What Nerve Ending is associated with taste?

Small Group C: What Nerve endings are associated with touch and pressure?

Small Group D: List five sense organs and their functions in man?

Small Group E: Carefully Label the diagram of the Nose, Skin, and tongue on the chalkboard.

Students Activity: Each group provides answers to the group questions.

Chalkboard Summary

The teacher goes through all the vital points by copying the notes for the students on the chalkboard and asks the students to copy them in their Biology notes. The teacher asks the students to read up the sense organs Eye and Ear before the next lesson.

(SMALL GROUP STRATEGY)

LESSON PLAN II FOR EXPERIMENTAL GROUP I

LESSON PLAN II

GROUP:	EXPERIENCE GROUP I
SUBJECT:	BIOLOGY
CLASS:	S.S II
WEEK:	Two
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years +
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	SENSE ORGANS [EYE AND EAR]

Instructional objectives (cognitive): at the end of week three, the students should be able to:

1. Identify the structure of the mammalian Eye and Ear
2. State the various parts to the mammalian Eye and Ear
3. State their various functions of these parts as it affects the process of seeing object, hearing and balancing.
4. Make diagrams of the mammalian Eye and Ear
5. State the various defects and corrections of the mammalian Eye
6. State the various care of the mammalian Ear

Instructional materials: charts showing the mammalian Eye and Ear, chalk, chalkboard, Biology Textbook (concise Biology by B.N Okoro)

Previous Knowledge: students are already familiar with the sense organs of Eye and Ear from J.S.S integrated science classes.

INSTRUCTIONAL PROCEDURES

STEP I: Introduction

The teacher welcomes the students to re-arrange the lesson room sitting arrangements and return back to them small groups. He further explains to the students on the need to work or collaborate in groups to achieve success.

STEP II: **Presentation and procedures**

The teacher introduces the lesson for the week as "the mammalian Eye and Ear". He proceeds to ask each group specific questions on the previous lesson as to ensure these the students understood the last weeks' lesson

Group A: which sense organ in the mammalian is used for feelings and temperature sensation?

Group B: Taste Buds are present in which sense organ of the body?

Group C: Oreva opens her cooler of food in the classroom and a very sweet aroma diffuses round the entire class. Which sense organ is responsible for the entire classroom students in perceiving that smell aroma?

Group D: choose one of your group members to go to the chalkboard and make a diagram of the skin and label it.

Group E: Define and list all the sense organ in the body and their various functions.

STUDENT ACTIVITY: Each group provides to their questions and are collectively praised for correct answers and encouraged to do better when not correct.

STEP III

The teacher proceeds to the lesson. He places a chart of the mammalian eye on the chalkboard. Step by step, the teacher explains the structure and functions of the mammalian eye using a ruler shows or touches all the various parts of the eye on the chart. He pronounces these the vital part take. Refrain, Aqueous humor, vitreous humour, central fovea optic naïve, chord layer pupil, iris, ciliary muscles etc. explain their functions clearly.

STEP IV

The teacher then pulse and tells each group to study the chart well quietly on their groups. He asks them to study it carefully and know the various parts and structures in the mammalian eye. He gives five minutes for thin exercise

Students Activity: the students in each group carefully study the chart and discuss amongst themselves. The teacher move from one group to the other guiding them through the process.

STEP V:

The teacher carefully explains to the students how the eye functions in the process of seeing placing emphasis on accommodation process. He progresses by discussing the various eye defects such as short-sightedness, long sightedness and astigmatism the corrections.

STEP VI:

The teacher quickly replaces the chart on the chalkboard with that of the mammalian ear. The teacher explains the structure of this ear and functions of the various parts. He asks each group to study the chart quietly.

Students Activity: Each group work together in their various group, Discussing the structure and functions of the mammalian ear in their groups.

STEP VII:

The teacher now explains the hearing and balancing function of the ear to the students. After which, the teacher explains the care of the mammalian ear.

STEP VIII

The teacher summarizes the entire lesson and re-explains to any group that did not understand the lesson properly.

STEP IX: EVALUATION

The teacher evaluates each group with different questions.

1. What is the function of the Aqueous humour in the mammalian eye?
2. What is the function of the cochlea in the mammalian ear?
3. What is accommodation in the mammalian ear?
4. The optic naive that runs from the eye to the brains serves which function?
5. What is the function of the 3 semi-circular canals in the ear?

The teacher now asks each group to make large labeled Diagrams of the mammalian eye and ear and submit in the next lesson.

STEP X: Chalkboard summary

The teacher goes through all the points by coping the chalkboard summary or notes for the students on the chalkboard. The teacher asks the student to prepare for next lesson and read up reproduction in man.

LESSON PLAN III

GROUP:	EXPERIMENTAL GROUP I
SUBJECT:	Biology
CLASS:	SSII
WEEK:	Three
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	REPRODUCTION IN MAN

Instructional Objectives (cognitive): At the end of week four, the students should be able to:

a) Define the term Reproduction

b) State and explain the various types of reproduction

c) Identify the reproductive organs of male and female

d) Identify the structure and functions of various parts

e) Identify the male and female sex gametes

f) Draw and label the male and female reproduction organs and their sex gamete.

Instructional Materials: charts showing the mammalian reproductive organs of male and female, chalk, chalkboard, Biology Textbook (concise Biology by B.N Okoro)

Previous Knowledge: students are already familiar with the term reproduction in man from integrated science in J.S.S classes and characteristics of living things in S.S II

Instructional Procedures:

STEP I Reproduction

The teacher welcomes the students to the weeks' lesson and asks the student to go back to their original group and rearrange the class to suit previous class arrangement

STEP II Presentation and Procedures

The teacher introduces the lesson as reproduction in man. He then asks a few questions to the specific group based on assertion that the student has done some preparatory reading for the lesson.

Define the term reproduction in man

1. What is the male and female reproductive sex organ gamete?
2. List five features present in the male reproductive organs
3. List five features present the female reproductive organ
4. List two feature each in the male and female reproductive sex gamete

Students Activities: each group answers their questions and are collectively praised for the correct answers and encourage to do better when not correct

STEP III:

The teacher proceeds to the lesson proper. He hangs his charts on the chalk board showing the male and female reproductive organs. He define reproduction in man as process whereby reproduce younger offspring that resemble them or of the same species. He further explains to the students the structure and functions of the male and female reproductive organs

carefully making elaborate use of the chart on the board, the teacher shows the student all the various parts and their specific function in the reproductive process.

Student Activities: The students in their small groups listen carefully, following the teacher every step and explanation

STEP IV:

The teacher allows each group to study the chart of the reproductive organs of male and female for 5 minutes and discuss quietly among their group members.

Student Activities: the students in their group study the chart closely working together.

STEP V:

The teacher proceeds to explaining and discussing in details the male and female sex gamete. They call that of the male spermatozoa and that of the female Ova or egg. He then replaces the chart on the chalkboard with that of spermatozoa and Ova. He explains the structure of both carefully to the student. The teacher explains how these sex gamete functions in the reproduction process.

STEP VI:

The teacher summarizes the entire lesson and asks the student to discuss the lesson for 5 minutes and each group ask question on the part of the lesson not properly grasped.

Student Activities: The students discuss in their groups and ask question on the sections of the lesson not properly grasped.

STEP VII: EVALUATION

The teacher evaluate each group with different question to test their level of understanding

Group A: What is ovulation?

Group B: What is fertilization?

Group C: List six part if the female reproductive organs

Group D: List six parts of the male reproductive organs

Group E: Choose one member from your group to make a large labeled diagram of the spermatozoa on the chalkboard

STEP VIII:

The teacher ask each students to go and submit labeled diagram of the male and female reproductive organs in the next class and ask the student to read up and prepare for the next class. Developmental stages in toad and fish.

VIII: Chalk board Summary:

The teacher put down notes to be copied on the chalk board and instructs the student to copy

LESSON PLAN IV

GROUP: EXPERIMENTAL GROUP I

SUBJECT: Biology

CLASS: SSII

WEEK: Four

DURATION: 40 Minutes Per Period

AVERAGE AGE: 16 Years

STUDENT ABILITY: Mixed

SEX: Mixed

TOPIC: REPRODUCTION IN ANIMALS I

Instructional Objectives (cognitive): At the end of week four, the students should be able to:

a) Define reproduction
b) State the various types of metamorphosis
c) Identify example of in each case
d) Identify the various stages of development in toad, housefly and cockroach

Instructional materials: chart showing metamorphosis and stages of development in toad, housefly and cockroach, chalk, chalkboard, Biology Textbook.

Previous Knowledge: students are already familiar with the term reproduction from integrated science in J.S.S classes and from the last week's lesson.

Instructional Procedures

PERIOD I

STEP I: Introduction

The teacher welcomes the students to a new weeks' lesson and topic. He re-arranges the class room settings and asks the students' to return to their previous groups and work as a group. Previous knowledge & questions

STEP II: Presentation and procedure.

The teacher then presents the weeks' topic as reproduction in animals. He presents the unites of study on stage of development in toad, housefly and cockroaches. The teacher hangs a chart on the chalkboard though the various stages of development in toads. He gradually explains each stage. He now defines metamorphic and their various types acting explain in each case.

STEP III:

The teacher asks the each group to carefully study the chart on the chalkboard and discuss it among themselves in 5 minutes. He goes round each group monitoring them quietly.

STEP IV:

The teacher proceeds gradually to the life cycle of housefly. He replaces the chart of stages of development of the toad and replaces it with a chart showing developmental stages of the housefly.

STEP V:

The teacher using the chart shows that the housefly undergoes complete metamorphoses. Using arrows show the stages from egg → larva → pupa → adult.

STEP VI:

The teacher summarizes the fast period lesson of the week before asking each group some questions to see if the lesson was properly grasped by the students'.

STEP VII: Evaluation

Group A: Define the term metamorphosis?

Group B: Reproduction in toad occurs where?

Group C: Using arrows show incomplete metamorphosis cycle flow

Group D: Fertilization in toad in internal or external

Group E: List the various types of metamorphosis and explain each.

PERIOD II

STEP I:

The teacher welcomes the students to the second period of the week on the topic reproduction in animals: stages of development in toad, housefly and cockroaches.

STEP II

The teacher asks each group the same questions he asked in the previous lesson or class before proceeding to the days' class.

STEP III

The teacher now begins with the stages of development in cockroaches.

He explains to the student that cockroaches exhibit incomplete metamorphosis. he places a chart on the reproductive cycle of cockroaches on the chalkboard and asks the students to carefully study the chart in their groups for 5 minutes.

STEP IV

The teacher proceeds explaining each stage in the reproductive cycle to the students, giving characteristics in each phase.

STEP V: Students activity.

The teacher now allows each group to minutes to make large labeled Diagrams of the reproductive cycles in housefly and cockroaches. He goes from group to group supervising carefully and quietly.

STEP VI

The teacher after 10 minutes goes round each group to score their Diagrams and praise each group for their collective efforts on the assignment.

STEP VII: Student activity

The teacher then summarizes the entire lesson of the week and asks each group to ask questions on the sections of the lesson not properly understood.

STEP VIII

The teacher now evaluate each group with a few questions and asks them to read up reproduction in fishes, reptiles, toads, amphibian, and mammals before the next weeks' lesson.

STEP IX Evaluation

Group A: What is incomplete metamorphosis?

Group B: What is complete metamorphosis?

Group C: Define the term metamorphosis?

Group D: Give 4 examples of organism that show incomplete metamorphosis.

Group E: Give 3 examples of organism that show complete metamorphosis.

LESSON PLAN V

GROUP:	EXPERIMENTAL GROUP I
SUBJECT:	Biology
CLASS:	SSII
WEEK:	Five
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	REPRODUCTION IN ANIMALS II

Instructional Objectives (cognitive): At the end of week six, the students should be able to:

a) Compare reproduction processes in fish, reptiles, birds, amphibians and mammals

b) Illustrate these differences in a tabular form

c) State features peculiar to each case

Instructional Materials: chalk board, chalk and Biology Textbook, chart showing this comparism in fish, reptiles, birds, amphibians, and mammals.

Previous Knowledge: students are already familiar with reproduction process in mammals, fish and birds from S.S I and from previous lessons on reproduction.

Introduction

STEP I:

The teacher welcomes the student to another week and lesson. Again re-arranging the class asks the students to return to their various groups. The teacher then asks questions on the previous class. He does this by interchanging the group questions on evaluation in the previous class.

STEP II:

This teacher introduces the weeks' lesson as reproduction in animals with special emphasis on the comparison of the reproduction in fish, reptiles, birds, amphibians and mammals.

STEP III:

The teacher shares round the various groups charts on tabular forms showing and comparing reproduction in fish reptiles birds emphasis and mammals. The teacher gives each group 10 minutes to properly study the chart carefully before beginning the lesson.

STEP IV:

The teacher begins by explaining the characteristic features of the reproductive process in fish, reptiles and birds placing much emphasis on fertilization (external or internal), development process and parental care. The teacher places significant emphasis on this like river porous, oviparous

STEP V:

The teacher carefully explains all there in a tabular way so as not to confuse the students.

STEPVI:

The teacher summarizes the first period of the lesson and asks students' to ask questions on the lesson before to archest the group with specific questions.

STEP VII: Evaluation

The teacher now evaluates each group with question on the lesson.

Group A: Reproduction is fish in external or internal.

Group B: What in oviparous?

Group C: Reptiles are hermaphrodites. True or False?

Group D: Which of the following exhibits parental care

Group E: What is courtship behavior in birds?

PERIOD II

STEP I:

The teacher welcomes the students' to the day's lesson. A continuation of reproduction. (Comparison in fish, reptile, bird, amphibians and mammals).

STEP II:

The teacher interchanges the last lesson question to each group before he proceeds to the the lesson proper.

STEP III:

The teacher still using the tabular chart in each group continues from amphibian carefully explain the characteristics reproductive farmers to that of mammals.

STEP VI:

The teacher places much emphasis on parental care and the reproductive features. The teacher then asks the students' to ask question on explains the part not understood to the students'.

STEP V:

The teacher then summarizes the entire lesson before evaluating the class.

STEP VI: Evaluation

The teacher evaluates each group with questions.

Group A: Bat is a mammal. True or False?

Group B: Which of the following animals lay eggs (a) Reptiles (b) Birds (c) Mammals (d) Amphibian (e) A, B and C?

Group C: What is seasonal migration?

Group D: Distinguish between external and internal fertilization?

Group E: What is oviparous?

LESSON PLAN VI

GROUP:	EXPERIMENTAL GROUP I
SUBJECT:	Biology
CLASS:	SSII
WEEK:	Six
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	REPRODUCTION IN FLOWERING PLANTS

PERIOD I

STEP I:

The teacher welcomes the students to a new and final week of the experiment. He asks the students to return to their groups, arranging the class as in previous classes into small groups of A-G

STEP 2:

The teacher introduces the week's lesson on reproduction in flowering plants. He jointly asks the whole groups simple everyday questions like have you all seen a flower? Who can describe a flower? What are the different colours of flower you have seen?

Student Activity: The students respond to all teachers' question.

STEP 3:

The teacher shares charts of a flowering plant to all the various groups and allows the students 5 minutes to study the chart carefully and quietly in their groups. The teacher moves round each group supervising their chart studying.

STEP 4:

The teacher after the 5 minutes begins the lesson proper. The using the chart explains the structure and functions of the flower. He list the various parts of the flower as calyx, pedicel, receptacle, corolla, either styrene stamen etc staling their functions too.

STEP 5:

The teacher then gives another 10 minutes to each group to draw and label the flower even using the chart to serve as directions. The teacher goes round the group supervising their drawings. After 10 minutes he goes round to withdraw their drawings and scores each group work accordingly.

Student Activity: Students in their groups work together and make their drawings.

STEP 6

The teacher then summarizes the lesson and asks the students to ask questions on parts not properly understand and he re-explains to ensure that the students comprehend the class properly.

STEP 7: Evaluation

The teacher now evaluates the students' with some questions before ending the first period of the lesson.

Group A: What part of the flower protests it at bud stage?

Group B: What structure holds the flower of the main plant?

Group C: The female part of the flower is called?

Group D: The male part of the flower is called?

Group E: The function of attracting insect to the flower is cause by?

PERIOD II

STEP 1:

The teacher welcomes the students to the day's lesson. A continuation of reproduction in flowering plants. The teacher asks questions to the students to refresh their mind on topic interchanging the question of each group.

STEP 2

The teacher now gradually proceeds to the week's lesson: Pollination and fertilization. The teacher defines the term pollination; he defines pollination as the transfer of pollen grains from anther to stigma. He explains thoroughly and carefully the process and various types using example.

STEP 3

The teacher progresses explain the process of pollination before fertilization process. The teacher explains features and characteristics of wind and cross pollinated flowers.

STEP 4

The teacher summarizes the entire week lesson and asks the student to ask question on part of lesson not properly grasped and re-explain to student.

STEP 5: Evaluation

The teacher ask question to each group on evaluation.

GROUP A: What is wind pollination?

GROUP B: What is cross pollination?

GROUP C: What is function of the corolla in a flower?

GROUP D: What is the male sex gamete in a flower?

GROUP E: What is the female sex gamete in flower?

STEP 6: Chalkboard summary

The teacher gives the student chalkboard summary note on the chalkboard for the student to copy and read up

APPENDIX IV

Lesson Plan For Experimental Group II

(Peer Tutoring Strategy)

Lesson Note/Plan: No I

Group: Experimental Group II

Subject: Biology

Class: SS II

Week: Two

Duration: 40 Minutes Per Perio

Average Age: 16 Years +

Student Ability: Mixed

Sex: Mixed

Topic: Sense organs (Skin, Nose, Tongue)

Instructional Objectives (Cognitive): At the end of the week two, the student should be able to:

a. Define the term sense organs

b. Identify the skin, nose and tongue

c. Identify nerve endings associated with the skin, nose and tongue.

d. Identify the parts of brain associated with these sense organs

e. Identify the various functions of the skin, nose and tongue

f. Make diagrams and label the skin, nose and tongue,

Instructional Materials: Chart of the skin, nose and tongue, chalk, chalkboard, concise Biology, textbook by B.N Okoro.

Previous knowledge: Student are already familiar with sense organs from JSS classes.

Instructional Procedures

CONTENT DEVELOPMENT	PEER TUTOR ACTIVITIES	TUTEES ACTIVITIES	STRATEGIES
Sense organ: Nose, tongue and skin	**STEP 1: Entry Behaviour** The peer tutor introduces his/herself to group as their tutor. The tutor then begins by introducing the lesson of thee week as "sense organs" he/she proceeds by asking some questions to the group tutees based on their previous knowledge. 1) What are sense organ? 2) What organ in the body of man is used for tasting? 3) What organ in the body is used for smelling? 4) What organ in the body is used for feeling sensation of cold, touch and heat?	Tutees respond by welcoming the tutor The tutee in their group answers or tries to answer the questions	Questioning
	STEP II: The peer tutor then gradually, step by step explains what sense organs are. He/she explains that sense organs are functions for the adaptation of organism to their environment. He/she explain that these specific functions are peculiar to mammal or man. He/she then lists the five major sense organs and their functions Eye- organ of sight Ear- organ of hearing and balancing. Nose- organ of smell tongue- organ of taste Skin- organ of touch, pain, pressure and perceptive feeling.	The tutees in their group listen attentively to the tutor.	Explanation and illustration
	STEP III The tutor using a char, then shows the tutees the structure of the nose, tongue and skin first. The tutor using the charts illustrates the various parts of these organs and their function.	The tutees observes carefully the structures of the various parts of these organs.	Observation.

	STEP IV: The tutors, then asks the tutees to focus and observe the structures and watch him/her make a drawing of the sense organ and also help to practice the process of the drawing. The tutor gives 10 minutes to the tutees in the group to practice the drawing and labeling carefully guiding every step in the process.	The tutees listen attentively and observe, studying the chart. The tutees practice the drawing of the sense organ nose, skin and tongue.	Explanation Observation Demonstration
	STEP V The tutor now carefully explains to the tutees how the nose, tongue and skin are able to carry out their functions effectively. He/she explain to the tutee how the brain plays a major role in sense organs. He further progresses, explaining that the nerve ending associated with the sense organs are thus: Nose-Olfactory nerve, Skin-Corpuscles of touch, heat, pressure and pair and the tongue-Taste buds, all associated with the brain.	The tutee listen attentively and observe, studying the charts.	Explanation Observation Demonstration
	STEP VI The pear tutor summarizes the lesson explaining the importance of the sense of taste, smell and feeling in our environment adaptation to ensure that the lesson was understood.		
	STEP VII: EVALUATION The peer tutor now asks a few questions to the tutees as to ensure that the lesson was grasped to a significant extent. 1) What is the organ of smell? 2) What nerve ending in associated the organ of taste? 3) List 5 sense organs 4) When a girl tries to find out if there is enough salt in the beans she is cooking, which sense organ those she make use of?	The tutor answer the questions	Questioning

	STEP VIII The tutor asks the tutees to ask any question on parts of the lesson they did not grab or understand perfectly and the tutor answers them carefully.	The tutee ask tutor question on parts not understood.	Questioning.
	STEP IX: **CHALKBOARD SUMMARY** The tutor writes on the chalkboard to give the tutees notes to copy and tells the tutees to read up the sense organ of eye and ear before the next class.	Tutees copy notes on the lesson taught.	

LESSON PLAN II FOR EXPERIMENTAL GROUP II

[PEER TUTORING]

GROUP: EXPERIENCE GROUP II

SUBJECT: Biology

CLASS: SSS II

WEEK: Two

DURATION: 40 Minutes Per Period

AVERAGE AGE: 16 Years +

STUDENT ABILITY: Mixed

SEX: Mixed

TOPIC: SENSE ORGANS [EYE AND EAR]

Instructional objectives (cognitive): at the end of week three, the students should be able to:

1. Identify the structure of the mammalian Eye and Ear

2. State the various parts to the mammalian Eye and Ear

3. State their various functions of these parts as it affects the process of seeing object, hearing and balancing.

4. Make diagrams of the mammalian Eye and Ear

5. State the various defects and corrections of the mammalian Eye

6. State the various care of the mammalian Ear

Instructional materials: charts showing the mammalian Eye and Ear, chalk, chalkboard, Biology Textbook (concise Biology by B.N Okoro)

Previous Knowledge: students are already familiar with the sense organs of Eye and Ear from J.S.S integrated science classes.

Instructional Procedures

PERIOD I

CURRENT DEVELOPMENT	PEER TUTORING ACTIVITIES	TUTEES ACTIVITIES	STRATEGIES
Sense Organ II Mammalian Eye and Ear	**STEP I:** Entry Behaviuor. The Peer Tutoring greets the group. The tutor introduces the week's lesson as sense organ: mammalian Eye and Ear, but before proceeding asks some questions on the previous weeks lesson 1. Which sense organ in the mammalian is used for feelings and temperature sensation? 2. Taste Buds are present in which sense organ of the body? 3. Oreva opens her cooler of food in the classroom and a very sweet aroma diffuses round the entire class. Which sense organ is responsible for the entire classroom students in perceiving that smell aroma? 4. Choose one of your group members to go to the chalkboard and make a diagram of the skin and label it. 5. Define and list all the sense organ in the body and their various functions.	The tutees responds Tutees answer the question	
	STEP II The peer tutor proceeds by providing a chart to the group on the		

	mammalian Eye. The tutor gradually step by step shows the tutees the structure of the mammalian Eye. Using the chart, the tutor explains the functions of the various parts of the mammalian. The tutor places much emphasis on the retina, Lens, Iris, Pupil, Ciliary muscles, Aqueous and Vitreous humour, Choroid layer optic nerve e.t.c The tutor carrying the tutees along explains how the mammalian Eye functions in the seeing process, defects of the Eye and correction. The tutor then summarizes the lesson of the first period and asks if the tutees understand the lesson and patiently re-explains the part the tutees did not understand.	Tutees listen and watch the tutor attentively The tutees observing the chart carefully notice all these parts and their functions The tutees listen attentively to the tutor The tutees ask the tutor to re-explain the part not properly understood	Explanation and observation 0bservation listening Questioning

PERIOD II

CONTENT DEVELOPMENT	PEER TUTOR ACTIVITIES	PEER TUTEE ACTIVITIES	STRATEGIES
	The tutor welcomes the tutee to lesson and second period of the week's lesson. Tutor introduces the lesson for the day on mammalian Ear.	Tutees welcome the tutor	Observation
	The tutor places a chart of the mammalian Ear at the centre of the tutees and instructs the tutees to study and observe the chart carefully.	Tutee observe and study the chart carefully	
	The tutor using the in front of the tutees explains the structure of the mammalian ear to the tutees.	Tutees listen attentively to the tutor	Listening and observation
	The tutor explains that the ear has the three (3) parts the outer, middle, and inner ear.		
	The tutor step by step gradually after explaining the structure, proceeds to the functions of the various parts observed in the diagram	Tutees watch and listen attentively	
	The tutor proceeds thoroughly explaining how the ear functions in the hearing and balancing process.		
	The tutor finally explains to the tutees the care of the mammalian ear and summarizes the entire week's lesson on sense	Listen carefully and ask questions where necessary.	

	organ (mammalian Eye and Ear) **EVALUATION** The tutor now asks the tutee questions on the entire week's lesson to ascertain if the lesson was grasped. 1. What are sense organs? 2. The mammalian Ear has _____ parts? 3. Images are formed in what part of the Eye? 4. List 3 defects of the mammalian Eye 5. Taste buds are formed in what sense organ? 6. What part of the Ear is responsible for balancing? The tutor gives the tutees chalkboard summary and asks the tutees to copy in their Biology notes. The tutor asks the tutees to read up reproduction in man before the Next week's class.	Tutees try to answer the questions Tutees copy notes	Questioning Questioning and answering session

LESSON PLAN III

GROUP:	EXPERIMENTAL GROUP II
SUBJECT:	Biology
CLASS:	SSII
WEEK:	Three
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	REPRODUCTION IN MAN

Instructional Objectives (cognitive): At the end of week four, the students should be able to:

1. Define the term Reproduction
2. State and explain the various types of reproduction
3. Identify the reproductive organs of male and female
4. Identify the structure and functions of various parts
5. Identify the male and female sex gametes
6. Draw and label the male and female reproduction organs and their sex gamete.

Instructional Materials: charts showing the mammalian reproductive organs of male and female, chalk, chalkboard, Biology Textbook (concise Biology by B.N Okoro)

Previous Knowledge: Students are already familiar with the term reproduction in man from integrated science in J.S.S classes and characteristics of living things in S.S II

Instructional Procedure

Content Development	Peer Tutor's activities	Tutor's Activities	Strategies
	STEP I Reproduction The tutor welcomes the students to the weeks' lesson and asks the student to go back to their original group and re-arrange the class to suit previous class arrangement	Tutees welcome the tutor	
	STEP II Presentation and Procedures The tutor introduces the lesson as reproduction in man. He then asks a few questions to the specific group based on assertion that the student has done some preparatory reading for the lesson. 1.Define the term reproduction in man 2. What is the male and female reproductive sex organ gamete? 3.List five features present in the male reproductive organs 4.List five features present the female reproductive organ 5.List two feature each in the male and female reproductive sex gamete	Tutees answer the questions	Questioning
	STEP III: The tutor proceeds to the lesson proper. He hangs his charts on the	Tutee observe and	

	chalk board showing the male and female reproductive organs. He define reproduction in man as process whereby reproduce younger offspring that resemble them or of the same species. He further explains to the students the structure and functions of the male and female reproductive organs carefully making elaborate use of the chart on the board, the teacher shows the student all the various parts and their specific function in the reproductive process.	study the chart carefully Tutees listen attentively to the tutor	Observation
	STEP IV: The tutor allows each group to study the chart of the reproductive organs of male and female for 5 minutes and discuss quietly among their group members.	Tutees discuss among themselves	Observation and discussions
	STEP V: The tutor proceeds to explaining and discussing in details the male and female sex gamete. They call that of the male spermatozoa and that of the female Ova or egg. He then replaces the chart on the chalkboard with that of spermatozoa and Ova. He explains the structure of both carefully to the student. The teacher explains how these sex gamete functions in the reproduction process.	Tutees listening attentively to the tutor	Explanation, description and observation
	STEP VI: The tutor summarizes the entire lesson and asks the student to discuss the lesson for 5 minutes and each group ask question on the part of the lesson not properly grasped.	Tutees listen carefully to the summary of the lesson	
	STEP VII: EVALUATION The tutor evaluate each group with different question to test their level of understanding 1. What is ovulation? 2. What is fertilization? 3. List six part if the female reproductive organs	Tutees try to answer the questions together	

	4. List six parts of the male reproductive organs 5.Choose one member from your group to make a large labeled diagram of the spermatozoa on the chalkboard	in their groups	Evaluation
	STEP VIII: The tutor asks tutees in their groups to submit labeled diagram of the male and female reproductive organs in the next class and ask the student to read up and prepare for the next class. Developmental stages in toad and fish.	Tutees respond to the tutor in of their group	

LESSON PLAN IV

GROUP: EXPERIMENTAL GROUP II

SUBJECT: Biology

CLASS: SSII

WEEK: Four

DURATION: 40 Minutes Per Period

AVERAGE AGE: 16 Years

STUDENT ABILITY: Mixed

SEX: Mixed

TOPIC: REPRODUCTION IN ANIMALS I

Instructional Objectives (cognitive): At the end of week five, the students should be able to:

1. Define reproduction
2. State the various types of metamorphosis
3. Identify example of in each case
4. Identify the various stages of development in toad, housefly and cockroach

Instructional materials: chart showing metamorphosis and stages of development in toad, housefly and cockroach, chalk, chalkboard, Biology Textbook.

Previous Knowledge: students are already familiar with the term reproduction from integrated science in J.S.S classes.

Instructional Procedures

PERIOD I

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITY	PEER TUTEES ACTIVITY	STRATEGIES
	STEPI: INTRODUCTION The tutor welcomes the students to a new weeks' lesson and topic. He re-arranges the class room settings and asks the students' to return to their previous groups and work as a group. Previous knowledge & questions	Tutees welcome the tutor	

	STEP II: Presentation and procedure. The tutor then presents the weeks' topic as reproduction in animals. He presents the units of study on stage of development in toad, housefly and cockroaches. The teacher hangs a chart on the chalkboard though the various stages of development in toads. He gradually explains each stage. He now defines metamorphic and their various types acting explain in each case.	Tutees listen attentively to the tutor	listening
	STEP III: The tutor asks the each group to carefully study the chart on the chalkboard and discuss it among themselves in 5 minutes. He goes round each group monitoring them quietly.	Tutee study the chart carefully	Illustration and observation
	STEP IV: The tutor proceeds gradually to the life cycle of housefly. He replaces the chart of stages of development of the toad and replaces it with a chart showing developmental stages of the housefly. **STEP V:** The tutor using the chart shows that the housefly undergoes complete metamorphoses. Using arrows show the	Tutees listen attentively to the tutor	Observation

	stages from egg → larva → pupa adult. →	Tutee study the chart carefully	observation
	STEP VI: The tutor summarizes the fast period lesson of the week before asking each group some questions to see if the lesson was properly grasped by the students'.	Tutee listen to the summary attentively	
	STEPVII: **Evaluation** 1. Define the term metamorphosis? 2. Reproduction in toad occurs where? 3. Using arrows show incomplete metamorphosis cycle flow 4. Fertilization in toad in internal or external 5. List the various types of metamorphosis and explain each.	Tutees try to answer the question	Evaluation

PERIOD II

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITY	PEER TUTEES ACTIVITY	STRATEGIES
	STEP I: The tutor welcomes the students to the second period of the week on the topic reproduction in animals: stages of development in toad, housefly and cockroaches.	Tutee welcome the tutor	
	STEP III The tutor now begins with the stages of development in cockroaches. He explains to the student that cockroaches exhibit incomplete metamorphosis. he places a chart on the reproductive cycle of cockroaches on the chalkboard and asks the students to carefully study the chart in their groups for 5 minutes.	Tutees listen attentively and study the chart	Illustration and observation
	STEP IV The tutor proceeds explaining each stage in the reproductive cycle to the students, giving characteristics in each phase.	Tutees listen attentively to the tutor	Listening and observation
	STEP V: The tutor now allows each group to make large labeled Diagrams of the reproductive cycles in housefly and cockroaches. He goes from group to group supervising carefully and	Tutee draws the diagrams	

	quietly.		
	STEP VI The tutor after 10 minutes goes round each group to score their Diagrams and praise each group for their collective efforts on the assignment.		
	STEP VII: The tutor then summarizes the entire lesson of the week and asks each group to ask questions on the sections of the lesson not properly understood.	Tutee listen attentively to the summary	Summarization and observation
	STEP IX Evaluation 1. What is incomplete metamorphosis? 2. What is complete metamorphosis? 3. Define the term metamorphosis? 4. Give 4 examples of organism that show incomplete metamorphosis. 5. Give 3 examples of organism that show complete metamorphosis.	Tutee answer the questions	Evaluation

LESSON PLAN V FOR EXPERIENCE GROUP II

[PEER TUTORING]

GROUP:	EXPERIENCE GROUP II
SUBJECT:	Biology
CLASS:	SSS II
WEEK:	Five
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years +
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	REPRODUCTION IN ANIMALS II

Instructional Objectives (cognitive): At the end of week six, the students should be able to:

1. Compare reproduction processes in fish, reptiles, birds, amphibians and mammals
2. Illustrate these differences in a tabular form
3. State features peculiar to each case

Instructional Materials: chalk board, chalk and Biology Textbook, chart showing this comparism in fish, reptiles, birds, amphibians, and mammals.

Previous Knowledge: students are already familiar with reproduction process in mammals, fish and birds from S.S I

Instructional Procedure:

Content Development	Peer Tutor's activities	Tutor's Activities	Strategies
	STEP I: Introduction The tutor welcomes the students to a new weeks' lesson and topic. He re-arranges the class room settings and asks the students' to return to their previous groups and work as a group. Previous knowledge & questions	Tutees welcome the tutor	
	STEP II: Presentation and procedure. The tutor then presents the weeks' topic as reproduction in animals. He presents the unites of study on stage of development in toad, housefly and cockroaches. The teacher hangs a chart on the chalkboard though the various stages of development in toads. He gradually explains each stage. He now defines metamorphic and their various types acting explain in each case.	Tutees observing the chart carefully	Observation
	STEP III: The tutor asks the each group to carefully study the chart on the chalkboard and discuss it among themselves in 5 minutes. He goes round each group monitoring them quietly.	Tutees discussing among themselves	Discussion and observation
	STEP IV: The tutor proceeds gradually to the life cycle of housefly. He replaces the chart of stages of development of the toad and replaces it with a chart showing developmental stages of the housefly.	Tutees study the chart carefully	Illustration and observation

	STEP V: The tutor using the chart shows that the housefly undergoes complete metamorphoses. Using arrows show the stages from egg larva pupa . adult → → →	The tutees observe and study the chart	illustration
	STEP VI: The tutor summarizes the fast period lesson of the week before asking some questions to see if the lesson was properly grasped by the students'.	Tutees listen attentively to the summary of the lesson	Summarization and explanation
	STEP VII: Evaluation 1. Define the term metamorphosis? 2. Reproduction in toad occurs where? 3. Using arrows show incomplete metamorphosis cycle flow 4. Fertilization in toad in internal or external 5. List the various types of metamorphosis and explain each.	Tutees answer the question	Evaluation

LESSON PLAN VI

GROUP: EXPERIMENTAL GROUP II

SUBJECT: Biology

CLASS: SSII

WEEK: Six

DURATION: 40 Minutes Per Period

AVERAGE AGE: 16 Years

STUDENT ABILITY: Mixed

SEX: Mixed

TOPIC: REPRODUCTION IN FLOWERING PLANTS

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITY	PEER TUTEES ACTIVITY	STRATEGIES
	STEP I: The tutor welcomes the students to a new and final week of the experiment. He asks the students to return to their groups, arranging the class as in previous classes into small groups of A-G	Tutees welcome the tutor	
	STEP 2: The tutor introduces the week's lesson on reproduction in	Tutees listens carefully	Listening and

	flowering plants. He jointly asks the whole groups simple everyday questions like have you all seen a flower? Who can describe a flower? What are the different colours of flower you have seen? Student Activity The students respond to all teachers' question.	Tutees answer the questions	observation Questioning
	STEP 3: The tutor shares charts of a flowering plant to all the various groups and gives the students 5 minutes to study the chart carefully and quietly in their groups. The teacher moves round each group supervising their chart studying.	Tutees studying the chart carefully	Observation and supervision
	STEP 4: The tutor after the 5 minutes begins the lesson proper. Then using the chart explains the structure and functions of the flower. He lists the various parts	Tutees listening attentively to the tutor	Observation and illustration

	of the flower as calyx, pedicel, receptacle, corolla, either styrene stamen etc staling their functions too.		
	STEP 5: The tutor then gives another 10 minutes to each group to draw and label the flower even using the chart to serve as directions. The teacher goes round the group supervising their drawings. After 10 minutes he goes round to withdraw their drawings and scores each group work accordingly.	Tutees draws the diagram as illustrated	Observation and illustration
	STEP 6 The tutor then summarizes the lesson and asks the students to ask questions on parts not properly understand and he re-explains to ensure that the students comprehend the class properly.	Tutees listen carefully to the summary	summarization
	STEP 7: Evaluation The tutor now evaluates the students' with some questions before ending the first period of the lesson. 1. What part of the flower protests it at bud stage? 2. What structure holds the flower of the main plant? 3. The female part of the flower is called? 4. The male part of the flower is called? 5. The function of	Tutees try to answer the questions	

	attracting insect to the flower is cause by?		evaluation

PERIOD II

CONTENT DEVELOPMENT	PEER TUTOR ACTIVITY	PEER TUTEE ACTIVITY	STRATEGIES
	STEP 1: The tutor welcomes the students to the day's lesson. A continuation of reproduction in flowering plants. The teacher asks questions to the students to refresh their mind on topic interchanging the question of each group.	Tutees welcome the tutor	
	STEP 2 The tutor now gradually proceeds to the week's lesson: Pollination and fertilization. The tutor defines the term pollination; he defines pollination as the transfer of pollen grains from anther to stigma. He explains thoroughly and carefully the process and various types using example.	Tutees listen carefully to the tutor	Explanation and observation
	STEP 3 The tutor progresses explain the	Tutees listen attentively to the tutor	observation

	process of pollination before fertilization process. The teacher explains features and characteristics of wind and cross pollinated flowers.		
	STEP 5: Evaluation The tutor ask question to each group on evaluation. 1. What is wind pollination? 2. What is cross pollination? 3. What is function of the corolla in a flower? 4. What is the male sex gamete in a flower? 5. What is the female sex gamete in flower?	Tutees answer the questions	Evaluation
	STEP 6: Chalkboard summary The tutor gives the tutees chalkboard summary note on the chalkboard for the tutees to copy and read up	The tutees copy the notes	Summarization and note copying

APPENDIX V

Lesson Plan For Control Group

(Lecture Method)

Lesson Note/Plan: No I

Group: Control Group

Subject: Biology

Class: SS II

Week: One

Duration: 40 Minutes Per Period

Average Age: 16 Years +

Student Ability: Mixed

Sex: Mixed

Topic: SENSE Organs (Nose, skin and tongue)

Instructional Objectives (Cognitive): At the end of the week two, the student should be able to:

a. Define the term sense organs

b. Identify the skin, nose and tongue

c. Identify nerve endings associated with the skin, nose and tongue.

d. Identify the parts of brain associated with these sense organs

e. Identify the various functions of the skin, nose and tongue

f. Make diagrams and label the skin, nose and tongue,

Instructional Materials: Chart of the skin, nose and tongue, chalk, chalkboard, concise Biology, textbook by B.N Okoro.

Previous Knowledge: Student are already familiar with sense organs from JSS classes.

STEP 1: Introduction

The teacher welcomes the students to a new session and class. He/she then proceeds by introducing the weeks lesson as sense organs. He then asks a few questions to list their knowledge on sense organ taught to the students in JSS classes of integrated science.

a) What are sense organs?

b) List 5 sense organs in your body

c) State their functions

d) What sense organ is used for smelling?

Student's Activities: The student to respond by answering the questions.

STEP II: Explanation

The teacher now gradually defines and explains the term sense organs to the students. He defines these organs with special functions in the mammalian body, carrying out special functions for the adaptation of the mammal to the environment. He lists the five sense organs in man and their specific functions as follows:

Eye----------Organ of sight

Ear----------Organ of hearing and balancing

Nose----------Organ of smell

Tongue----------Organ of taste

Skin----------Organ of touch, pain, pressure and perception (feeling)

STEP III

The teacher proceeds to explaining step by step the structure of nose, skin tongue using a chart in all cases. The charts are attached to the chalkboard from where he shows by illustrations

of all parts. He further explains how these sense organs are connected to the brain through nerve endings.

STEP IV

The teacher now summarizes the lesson to ensure that the student have the privilege of understanding the areas they got lost in the course of the lesson.

STEP V: Evaluation

The teacher asks the students a few questions from the lesson taught to find out if the lesson was well grasped by the students.

1) What is the organ of smell?

2) What nerve ending in associated the organ of taste?

3) List 5 sense organs.

4) When a girl tries to find out if there is enough salt in the beans she is cooking, which sense organ those she make use of?

Student Activity: The student's respond to the questions asked by the teacher.

STEP VI: Chalkboard Summary

The teacher goes through all the vital points by copying the notes for the students on the chalkboard and asks the students to copy them in their Biology.

CONTROL GROUP

LESSON PLAN II

GROUP:	CONTROL GROUP (LECTURE METHOD)
SUBJECT:	Biology
CLASS:	SSS II
WEEK:	Two
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years +
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	SENSE ORGANS [EYE AND EAR]

Instructional objectives (cognitive): at the end of week three, the students should be able to:

i. Identify the structure of the mammalian Eye and Ear

ii. State the various parts to the mammalian Eye and Ear

iii. State their various functions of these parts as it affects the process of seeing object, hearing and balancing.

iv. Make diagrams of the mammalian Eye and Ear

v. State the various defects and corrections of the mammalian Eye

vi. State the various care of the mammalian Ear

Instructional materials: charts showing the mammalian Eye and Ear, chalk, chalkboard, Biology Textbook (concise Biology by B.N Okoro)

Previous Knowledge: students are already familiar with the sense organs of Eye and Ear from J.S.S integrated science.

PERIOD I

INSTRUCTIONAL PROCEDURES

STEP I: Introduction

The teacher welcomes the students to re-arrange the lesson room sitting arrangements and return back to them small groups. He further explains to the students on the need to work or collaborate in groups to achieve success.

STEP II: **Presentation and procedures.**

The teacher introduces the lesson for the week as “the mammalian Eye and Ear”. He proceeds to ask each group specific questions on the previous lesson as to ensure these the students understood the last weeks’ lesson

1. Which sense organ in the mammalian is used for feelings and temperature sensation?
2. Taste Buds are present in which sense organ of the body?
3. Oreva opens her cooler of food in the classroom and a very sweet aroma diffuses round the entire class. Which sense organ is responsible for the entire classroom students in perceiving that smell aroma?
4. Choose one of your group members to go to the chalkboard and make a diagram of the skin and label it.
5. Define and list all the sense organ in the body and their venous functions.

STUDENT ACTIVITY: Each group provides to their questions and are collectively praised for correct answers and encouraged to do better when not correct.

STEP III

The teacher proceeds to the lesson. He places a chart of the mammalian eye on the chalkboard. Step by step, the teacher explains the structure and functions of the mammalian eye using a ruler shows or touches all the various parts of the eye on the chart. He pronounces these the vital part take. Refrain, Aqueous humor, vitreous humour, central fovea optic naïve, chord layer pupil, iris, ciliary muscles etc. explain their functions clearly.

STEP IV

The teacher then pulse and tells each group to study the chart well quietly on their groups. He asks them to study it carefully and know the various parts and structures in the mammalian eye. He gives five minutes for thin exercise

Students Activity: the students in each group carefully study the chart and discuss amongst themselves. The teacher move from one group to the other guiding them through the process.

STEP V:

The teacher carefully explains to the students how the eye functions in the process of seeing placing emphasis on accommodation process. He progresses by discussing the various eye defects such as short-sightedness, long sightedness and astigmatism the corrections.

EP VI:

The teacher quickly replaces the chart on the chalkboard with that of the mammalian ear. The teacher explains the structure of this ear and functions of the various parts. He asks each group to study the chart quietly.

Students Activity: Each group work together in their various group, Discussing the structure and functions of the mammalian ear in their groups.

STEP VII:

The teacher now explains the hearing and balancing function of the ear to the students. After which, the teacher explains the care of the mammalian ear.

STEP VIII

The teacher summarizes the entire lesson and re-explains to any group that did not understand the lesson properly.

STEP IX: EVALUATION

The teacher evaluates each group with different questions.

1. What is the function of the Aqueous humour in the mammalian eye?
2. What is the function of the cochlea in the mammalian ear?
3. What is accommodation in the mammalian ear?
4. The optic naive that runs from the eye to the brains serves which function?
5. What is the function of the 3 semi-circular canals in the ear?

The teacher now asks each group to make large labeled Diagrams of the mammalian eye and ear and submit in the next lesson.

STEP X: Chalkboard summary

The teacher goes through all the points by coping the chalkboard summary or notes for the students on the chalkboard. The teacher asks the student to prepare for next lesson and read up reproduction in man.

CONTROL GROUP

LESSON PLAN III

GROUP:	CONTROL GROUP (LECTURE METHOD)
SUBJECT:	Biology
CLASS:	SSII
WEEK:	Three
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	REPRODUCTION IN MAN

Instructional Objectives (cognitive): At the end of week four, the students should be able to:

i. Define the term Reproduction

ii. State and explain the various types of reproduction

iii. Identify the reproductive organs of male and female

iv. Identify the structure and functions of various parts

v. Identify the male and female sex gametes

vi. Draw and label the male and female reproduction organs and their sex gamete.

Instructional Materials: charts showing the mammalian reproductive organs of male and female, chalk, chalkboard, Biology Textbook (concise Biology by B.N Okoro)

Previous Knowledge: students are already familiar with the term reproduction in man from integrated science in J.S.S classes and characteristics of living things in S.S II

Instructional Procedures

STEP I Presentation and Procedures

The teacher welcomes the students to the week's lesson. He introduces the lesson as reproduction in man. He then asks a few questions to the specific group based on assertion that the student has done some preparatory reading for the lesson.

Define the term reproduction in man

1. What is the male and female reproductive sex organ gamete?
2. List five features present in the male reproductive organs
3. List five features present the female reproductive organ
4. List two feature each in the male and female reproductive sex gamete

Students Activities: student answers their questions.

STEP II:

The teacher proceeds to the lesson proper. He hangs his charts on the chalk board showing the male and female reproductive organs. He define reproduction in man as process whereby reproduce younger offspring that resemble them or of the same species. He further explains to the students the structure and functions of the male and female reproductive organs

carefully making elaborate use of the chart on the board, the teacher shows the student all the various parts and their specific function in the reproductive process.

Student Activities: The students listen carefully, following the teacher every step and explanation

STEP IV:

The teacher allows students to study the chart of the reproductive organs of male and female for 5 minutes and discuss quietly among their group members.

Student Activities: The students study the chart closely working together.

STEP V:

The teacher proceeds to explaining and discussing in details the male and female sex gamete. They call that of the male spermatozoa and that of the female Ova or egg. He then replaces the chart on the chalkboard with that of spermatozoa and Ova. He explains the structure of both carefully to the student. The teacher explains how these sex gamete functions in the reproduction process.

STEP VI:

The teacher summarizes the entire lesson and asks the student to discuss the lesson for 5 minutes and each group ask question on the part of the lesson not properly grasped.

Student Activities: The students discuss and ask question on the sections of the lesson not properly grasped.

STEP VII: EVALUATION

The teacher evaluate the students with different question to test their level of understanding

1. What is ovulation?

2. What is fertilization?
3. List six part if the female reproductive organs
4. List six parts of the male reproductive organs
5. Choose one member from your group to make a large labeled diagram of the spermatozoa on the chalkboard

STEP VIII:

The teacher ask each students to go and submit labeled diagram of the male and female reproductive organs in the next class and ask the student to read up and prepare for the next class. Developmental stages in toad and fish.

VIII: Chalk board Summary:

The teacher put down notes to be copied on the chalk board and instructs the student to copy

CONTROL GROUP

LESSON PLAN IV

GROUP:	CONTROL GROUP (LECTURE METHOD)
SUBJECT:	Biology
CLASS:	SSII
WEEK:	Four
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	REPRODUCTION IN ANIMALS

Instructional Objectives (cognitive): At the end of week five, the students should be able to:

i. Define reproduction

ii. State the various types of metamorphosis

iii. Identify example of in each case

iv. Identify the various stages of development in toad, housefly and cockroach

Instructional materials: chart showing metamorphosis and stages of development in toad, housefly and cockroach, chalk, chalkboard, Biology Textbook.

Previous Knowledge: students are already familiar with the term reproduction from integrated science in J.S.S classes.

Instructional Procedures

PERIOD I

STEP I: Introduction

The teacher welcomes the students to a new weeks' lesson and topic. He re-arranges the class room settings and asks the students' to return to their previous groups and work as a group. Previous knowledge & questions

STEP II: Presentation and procedure.

The teacher then presents the weeks' topic as reproduction in animals. He presents the unites of study on stage of development in toad, housefly and cockroaches. The teacher hangs a chart on the chalkboard though the various stages of development in toads. He gradually explains each stage. He now defines metamorphic and their various types acting explain in each case.

STEP III:

The teacher asks the each group to carefully study the chart on the chalkboard and discuss it among themselves in 5 minutes. He goes round each group monitoring them quietly.

STEP IV:

The teacher proceeds gradually to the life cycle of housefly. He replaces the chart of stages of development of the toad and replaces it with a chart showing developmental stages of the housefly.

STEP V:

The teacher using the chart shows that the housefly undergoes complete metamorphoses. Using arrows show the stages from egg → larva → pupa → adult.

STEP VI:

The teacher summarizes the fast period lesson of the week before asking each group some questions to see if the lesson was properly grasped by the students'.

STEP VII: Evaluation

1. Define the term metamorphosis?
2. Reproduction in toad occurs where?
3. Using arrows show incomplete metamorphosis cycle flow
4. Fertilization in toad in internal or external
5. List the various types of metamorphosis and explain each.

PERIOD II

STEP I:

The teacher welcomes the students to the second period of the week on the topic reproduction in animals: stages of development in toad, housefly and cockroaches.

STEP II

The teacher asks each group the same questions he asked in the previous lesson or class before proceeding to the days' class.

STEP III

The teacher now begins with the stages of development in cockroaches. He explains to the student that cockroaches exhibit incomplete metamorphosis. he places a chart on the

reproductive cycle of cockroaches on the chalkboard and asks the students to carefully study the chart in their groups for 5 minutes.

STEP IV

The teacher proceeds explaining each stage in the reproductive cycle to the students, giving characteristics in each phase.

STEP V: Students activity.

The teacher now allows each group to minutes to make large labeled Diagrams of the reproductive cycles in housefly and cockroaches. He goes from group to group supervising carefully and quietly.

STEP VI

The teacher after 10 minutes goes round each group to score their Diagrams and praise each group for their collective efforts on the assignment.

STEP VII: Student activity

The teacher then summarizes the entire lesson of the week and asks each group to ask questions on the sections of the lesson not properly understood.

STEP VIII

The teacher now evaluate each group with a few questions and asks them to read up reproduction in fishes, reptiles, toads, amphibian, and mammals before the next weeks' lesson.

STEP IX Evaluation

1. What is incomplete metamorphosis?
2. What is complete metamorphosis?
3. Define the term metamorphosis?
4. Give 4 examples of organism that show incomplete metamorphosis.
5. Give 3 examples of organism that show complete metamorphosis.

CONTROL GROUP

LESSON PLAN V

GROUP:	CONTROL GROUP (LECTURE METHOD)
SUBJECT:	Biology
CLASS:	SSII
WEEK:	Five
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	REPRODUCTION IN ANIMALS

Instructional Objectives (cognitive): At the end of week six, the students should be able to:

i. Compare reproduction processes in fish, reptiles, birds, amphibians and mammals

ii. Illustrate these differences in a tabular form

iii. State features peculiar to each case

Instructional Materials: chalk board, chalk and Biology Textbook, chart showing this comparism in fish, reptiles, birds, amphibians, and mammals.

Previous Knowledge: students are already familiar with reproduction process in mammals, fish and birds from S.S I

Introduction

STEP I:

The teacher welcomes the student to another week and lesson. Again re-arranging the class asks the students to return to their various groups. The teacher then asks questions on the previous class. He does this by interchanging the group questions on evaluation in the previous class.

STEP II:

This teacher introduces the weeks' lesson as reproduction in animals with special emphasis on the comparison of the reproduction in fish, reptile birds, amphibian and mammals.

STEP III:

The teacher shared round the various groups charts in tabular forms showing and comparing reproduction in fish reptiles birds emphasis and mammals. The teacher gives each group 10 minutes to properly study the chart carefully before beginning the lesson.

STEP IV:

The teacher begins by explain the chair acoustic features of the reproductive process in fishes reptiles and birds placing much emphasis on fertilization (external or internal), development process and parental care. The teacher places significant emphasis on this like river porous, oviparous

STEP V:

The teacher carefully explains all there in a tabular way so as not to confuse the students.

STEP VI:

The teacher summarizes the first period of the lesson and asks students' to ask questions on the lesson before to archest the group with specific questions.

STEP VII: Evaluation

The teacher now evaluates each group with question on the lesson.

1. Reproduction is fish in external or internal.
2. What in oviparous?
3. Reptiles are hermaphrodites. True or False?
4. Which of the following exhibits parental care
5. What is courtship behavior in birds?

PERIOD II

STEP I:

The teacher welcomes the students' to the Day's lesson. A continuation of reproduction comparison in fish, reptile bird, amphibians and mammals.

STEP II:

The teacher interchanges the last lesson question to each group before he proceeds to the lesson proper.

STEP III:

The teacher still using the tabular chart in each group continues from amphibian carefully explain the characteristics reproductive farmers to that of mammals.

STEP VI:

The teacher places much emphasis on parental care and the reproductive features. The teacher then asks the students' to ask question on explains the part not understood to the students'.

STEP V:

The teacher then summarizes the entire lesson before evaluating the class.

STEP VI: Evaluation

The teacher evaluates each group with questions.

1. Bat is a mammal. True or False?
2. Which of the following animals lay eggs (a) Reptiles (b) Birds (c) Mammals (d) Amphibian (e) A, B and C?
3. What is seasonal migration?
4. Distinguish between external and internal fertilization?
5. What is oviparous?

CONTROL GROUP

LESSON VI

GROUP:	CONTROL GROUP (LECTURE METHOD)
SUBJECT:	Biology
CLASS:	SSII
WEEK:	Six
DURATION:	40 Minutes Per Period
AVERAGE AGE:	16 Years
STUDENT ABILITY:	Mixed
SEX:	Mixed
TOPIC:	REPRODUCTION IN FLOWERING PLANTS

PERIOD I

STEP I:

The teacher welcomes the students to a new and final week of the experiment. He asks the students to return to their groups, arranging the class as in previous classes into small groups of A-G

STEP 2:

The teacher introduces the week's lesson on reproduction in flowering plants. He jointly asks the whole groups simple everyday questions like have you all seen a flower? Who can describe a flower? What are the different colours of flower you have seen?

Student Activity

The students respond to all teachers' question.

STEP 3:

The teacher shares charts of a flowering plant to all the various groups and allows the students 5 minutes to study the chart carefully and quietly in their groups. The teacher moves round each group supervising their chart studying.

STEP 4:

The teacher after the 5 minutes begins the lesson proper. The using the chart explains the structure and functions of the flower. He list the various parts of the flower as calyx, pedicel, receptacle, corolla, either styrene stamen etc staling their functions too.

STEP 5:

The teacher then gives another 10 minutes to each group to draw and label the flower even using the chart to serve as directions. The teacher goes round the group supervising their drawings. After 10 minutes he goes round to withdraw their drawings and scores each group work accordingly.

Student Activity: Students work together and make their Drawings.

STEP 6

The teacher then summarizes the lesson and asks the students to ask questions on parts not properly understand and he re-explains to ensure that the students comprehend the class properly.

STEP 7: Evaluation

The teacher now evaluates the students' with some questions before ending the first period of the lesson.

1. What part of the flower protests it at bud stage?
2. What structure holds the flower of the main plant?
3. The female part of the flower is called?
4. The male part of the flower is called?
5. The function of attracting insect to the flower is cause by?

PERIOD II

STEP 1:

The teacher welcomes the students to the day's lesson. A continuation of reproduction in flowering plants. The teacher asks questions to the students to refresh their mind on topic interchanging the question of each group.

STEP 2

The teacher now gradually proceeds to the week's lesson: Pollination and fertilization. The teacher defines the term pollination; he defines pollination as the transfer of pollen grains from anther to stigma. He explains thoroughly and carefully the process and various types using example.

STEP 3

The teacher progresses explain the process of pollination before fertilization process. The teacher explains features and characteristics of wind and cross pollinated flowers.

STEP 4

The teacher summarizes the entire week lesson and asks the student to ask question on part of lesson not properly grasped and re-explain to student.

STEP 5: Evaluation

The teacher ask question to each group on evaluation.

1. What is wind pollination?
2. What is cross pollination?
3. What is function of the corolla in a flower?
4. What is the male sex gamete in a flower?
5. What is the female sex gamete in flower?

STEP 6: Chalkboard summary

The teacher gives the student chalkboard summary note on the chalkboard for the student to copy and read up.

APPENDIX VI

CONSTRUCT VALIDITY

Item Difficulty Level

Item difficulty was determined by the percentage of candidates that got the right answer out of the total respondents. The formula for calculating the item difficulty (p) is

$$P = \frac{N \times 100}{T}$$

P = Item difficulty level

N = Number of students who got the answer right

T = Total number of candidates

Item Discrimination Index (D)

$$D = \frac{\sum H + \sum L}{2N (Smax - Smin}$$

$\sum H$ = Sum of scores of upper

$\sum L$ = Sum of scores of lower

N = Number of students tested

Smax = Highest score on the question

Smin = Lowest score on the question

P = Level of difficulty

$$P = \frac{N * 100}{T}$$

D = DISCRINATION

$$D = \frac{RH - RL}{NH}$$

	DIFFICULTY LEVEL %	DISCRIMINATION LEVEL
1.	25	0.5
2.	40	0.2
3.	35	0.3
4.	55	0.4
5.	30	0.2
6.	85	0.3
7.	60	0.4
8.	40	0.3
9.	40	0.5

10.	95	0.1
11.	55	0.5
12.	75	0.3
13.	95	0.1
14.	65	0.3
15.	40	0.4
16.	45	0.3
17.	90	0
18.	25	0.3
19.	60	0.2
20.	45	0.2
21.	65	0.3
22.	20	0.2
23.	35	0.2
24.	10	0
25.	30	0.2
26.	30	0.4

27. 10	0.1
28. 30	0.2
29. 40	0.2
30. 30	0.2
31. 25	0.5
32. 20	0
33. 90	0.2
34. 45	0.1
35. 40	0.3
36. 10	0
37. 35	0.1
38. 10	-0.1
39. 85	0.3
40. 20	0.2

APPENDIX VII

Details of reliability co-efficient of Student Biology Achievement Test (SBAT)

The formula for Kuder-Richardson 21 is as follows:

Kuder – Richardson Formula 21: Rxx = $\frac{n}{n-1}(1 - \bar{x}\frac{(n-\bar{x})}{nsx^2}$

Where n = No of items

$\bar{x}$ = mean

S = Standard Deviation

S^2 = Variance

(See appendix VII for details of computation of reliability co-efficient).

	SCORES(X)	X-X	(X-X)
1	11	-3.5	12.25
2	25	10.5	110.25
3	17	2.5	6.25
4	13	-1.5	2.25
5	21	6.5	42.25
6	23	8.5	72.25
7	8	-6.5	42.25
8	14	-0.5	0.25
9	19	4.5	20.25
10	7	-7.5	56.25
11	9	-5.5	30.25
12	10	-4.5	20.25
13	22	7.5	56.25
14	15	0.5	0..25
15	11	-3.5	12.25
16	8	-6.5	42.25
17	18	3.5	12.25
18	6	-8.5	72.25
19	13	-1.5	2.25
20	20	5.5	30.25

RXX = $\frac{n}{n-1}\left(1 - \frac{x(n-x)}{nS_x^2}\right)$

= $\frac{30}{29}\left(1 - \frac{14.5\ (30-14.5)}{30\ x\ 33.84}\right)$

$= \frac{30}{29}\left(1 - \frac{224.75}{1015.20}\right)$

$= \frac{30}{29}\ (1 - 0.2214)$

$= \frac{30}{29}\ (0.7786)$

$= 0.8055$

RXX = <u>0.8</u>

APPENDIX VIII

Criteria Form for Validating The Student Biology Achievement Test (SBAT)

Preamble:

The attached validation questionnaire aims at investigating what the researcher actually did while choosing the test items and ensuring coverage of the content of the lessons.

Instruction: Kindly indicate by ticking the correct response options provided.

S/N	DESCRIPTION	OPTION Yes/No	RESPONSE
1.	Does the Student Biology Achievement Test request for information on the function of the retina in the mammalian eye?	Yes/No	
2.	Does the Student Biology Achievement Test request for the position of cochlea in ear?	Yes/No	
3.	Does the Student Biology Achievement Test request for an application of the knowledge of sense organs for a person who had an accident that affects the skull but not the nose and later lost the sense of smell?	Yes/No	
4.	Does the Student Biology Achievement Test request for information on the functions of the mammalian ear?	Yes/No	
5.	Does the Student Biology Achievement Test request for information on the application of knowledge of sense organs in determining when a boy drinks a bottle of coke and complains of bitterness?	Yes/No	
6.	Does the Student Biology Achievement Test request for information on the application of knowledge of sense organs in determining the part of the senses that operates when a girl is feeling cold?	Yes/No	
7.	Does the Student Biology Achievement Test request for information on the various parts of the mammalian ear?	Yes/No	
8.	Does the Student Biology Achievement Test request for information on spermatozoa as a sex gamete?	Yes/No	
9.	Does the Student Biology Achievement Test request for information on the various parts of the female reproductive organs in man?	Yes/No	
1(	Does the Student Biology Achievement Test request for	Yes/No	

	information on the release of egg, once monthly in female reproductive process?		
1	Does the Student Biology Achievement Test request for information on the process of release of spermatozoa during copulation process?	Yes/No	
1	Does the Student Biology Achievement Test request for information on why the reproductive organs are called Urino-Genital organs?	Yes/No	
1	Does the Student Biology Achievement Test request for information on the definition of fertilization?	Yes/No	
1	Does the Student Biology Achievement Test request for information on where fertilization occurs?	Yes/No	
1	Does the Student Biology Achievement Test request for information on examples of insect that undergo incomplete metamorphosis?	Yes/No	
1	Does the Student Biology Achievement Test request for information on the structure in which cockroaches store their eggs?	Yes/No	
1	Does the Student Biology Achievement Test request for information on thyroxin playing a role on the reproductive process of toads?	Yes/No	
1	Does the Student Biology Achievement Test request for information on the reproduction of toads being internal or external?	Yes/No	
1	Does the Student Biology Achievement Test request for information on examples of animals that undergo seasonal migration courtship behaviors?	Yes/No	
2	Does the Student Biology Achievement Test request for information on the male sex gamete in flowering plant?	Yes/No	
2	Does the Student Biology Achievement Test request for information on the parts of a flower that attracts pollinators?	Yes/No	
2	Does the Student Biology Achievement Test request for information on the examples of fruits called drupe?	Yes/No	
2	Does the Student Biology Achievement Test request for information on examples of fruits dispersed by explosive mechanism?	Yes/No	
2	Does the Student Biology Achievement Test request for information on examples of fruit dispersed by water?	Yes/No	
2	Does the Student Biology Achievement Test request for information on the position of the ovule in a flower?	Yes/No	
2	Does the Student Biology Achievement Test request for information on the occurrence of fertilization in a flower?	Yes/No	
2	Does the Student Biology Achievement Test request for information on the function of the stigma in a flower?	Yes/No	
2	Does the Student Biology Achievement Test request for information on the features of a wind pollinated flower?	Yes/No	

2	Does the Student Biology Achievement Test request for information on the duration of the test?	Yes/No	
3	Does the Student Biology Achievement Test request for information instructions regime choosing one option from A – D and correct answer to the test items?	Yes/No	
3	Does the Student Biology Achievement Test request for information for the name of the students, name of school, sex and experimental group?	Yes/No	

APPENDIX IX

Letter To Principal of Schools To Be Used For The Study

Department of Curriculum

Studies and Integrated Science,

Faculty of Education,

Delta State University,

Abraka.

20th September, 2015.

The Principal,

_____

_____

_____

Dear Sir,

Application To Use Your School For My Research Work

I, Juweto Akporoghene Godfrey, a post graduate student of the above named institution currently carrying out research on "Effect of Small Group and Peer Tutoring strategies on Students' Academic Achievement and Retention in Secondary School Biology" hereby solicit your permission to use the school for my PhD thesis covering about eight weeks.

This research work will involve only Senior Secondary School II Students (SS II) in your school. The school will be used as experimental and control groups which will entail teaching of Biology concepts by the regular teachers and selected peer tutors.

Thank you sir for your anticipated cooperation

Yours Faithfully,

Juweto A. Godfrey

APPENDIX X

A SIX WEEK INSTRUCTIONAL UNIT

Week	Unit	Content of instructional scheme	Instructional objectives
One	**1**	**SENSE ORGAN I** Organ of taste (TONGUE) Organ of Smell (NOSE) Organ of Touch (SKIN)	**The student will at the end of the lesson be able to:** 1. List the various sense organs in the human body. 2. State the various functions of these sense organs. 3. Explain the structure and functions of their various parts of the tongue, nose, and skin. 4. Draw and label the sense organs of tongue, nose and skin.
Two	**2**	**SENSE ORGAN II** Organ of sight (EYE) Organ of hearing and balancing (EAR)	1. Structure of the mammalian eye. 2. Functions of the various parts of the eye. 3. The process of seeing and accommodation. 4. State the defects associated with the mammalian eye and their corrections. 5. Structure and function of the mammalian ear. 6. Process of hearing and balancing. 7. Care of the ear.
Three	**3**	**reproduction in man** Male and female reproduction organs. Structure and functions of the reproduction organs. Sex gamete in man. Structure and functions of sex gamete.	**The students will at the end of the lesson be able to:** 1. Define the term reproduction. 2. Explain the structure and functions of the male and female reproductive organs. 3. Draw and label the male and female reproductive organ 4. Explain the term sex gamete 5. State the structure and functions of the male and female gamete.
Four	**4**	**REPRODUCTION IN ANIMALS I** Stages of development in toad, housefly and cockroaches	**The students will at the end of the lesson be able to:** 1. Identify the various developmental stages in toad, housefly and cockroaches. 2. Define and explain the meaning of

			metamorphosis and types. 3. Give example of organisms and their types of developmental cycles.
Five	**5**	**REPRODUCTION IN ANIMALS ii** Comparism of reproduction in fish, reptiles, birds, amphibians and mammals.	**The students will at the end be able to:** 1. Compare reproduction in fish, birds, amphibians and mammals, using a tabular form for simplicity.
Six	**6**	**REPRODUCTION IN FLOWERING PALNTS** Structure and functions of the flower. Pollination, conditions for pollination, types of pollination, fertilization.	**The students will at the end of the lesson be able to:** 1. Identify the various parts of the flower. 2. Explain and state the various functions of the different part of the flower. 3. Define pollination. 4. List the conditions for pollination. 5. List types of pollination. 6. Explain fertilization in plants.

APPENDIX XI

Students Biology Achievement Test

(SBAT)

SECTION A

INSTRUCTIONS: Answer all questions from this section mark (√) from the option A – D provided against each question.

PRE-TEST

Name of Student:……..…….
Name of School:……
Sex:……
Group:……
TIME: 1 Hour

1. Ability of the human eye to focus images accurately on the retina is called ……. (A) Astigmatism [ ], (B) Myopia [ ], (C) Adjustment [ ], (D) Accommodation [ ]
2. The cochlea is situated in. (A) Brain [ ], (B) Outer ear [ ], (C) Inner ear [ ], (D) Middle ear [ ]
3. A person had an accident that affects the skull but not the nose and later lost the sense of smell. The accidents must have affect the: (A) Nose of extension [ ], (B) Olfactory lobes of the brain [ ], (C) Passage from the nose to the brain [ ], (D) Part of the skull near the nose [ ]
4. Balancing is one of the functions of the (A) Tongue [ ], (B) Legs [ ], (C) Hands [ ], (D) Ear [ ]
5. Which of the following is responsible for the sensation of touch? (A) Hands [ ], (B) Skin [ ], (C) Ear [ ], (D) Olfactory [ ]
6. Semi circular canals are found in the (A) Ear [ ], (B) Tongue [ ], (C) Nose [ ], (D) Skin [ ]
7. A boy drinks, a bottle of coke and complains of bitterness, obviously he has a problem with his (A) Nose [ ], (B) Taste buds [ ], (C) Mouth [ ], (D) Teeth [ ]
8. A girl is feeling very cold, this means her…….is functioning properly. (A) Corsides in the skin [ ], (B) Clothes [ ], (C) Eye [ ], (D) Cochlea [ ]
9. Myopia is a defect of the. (A) Ear [ ], (B) Eye [ ], (C) Tongue [ ], (D) Skin [ ]
10. The outermost part of the mammalian ear is called? (A) Middle ear [ ], (B) Eustachian tube [ ], (C) Pinna [ ], (D) Auditory cornal [ ]
11. Spermatozoa are the sex gamete for…… (A)Female [ ], (B) Old women [ ], (C) Male [ ], (D) Reproduction [ ]
12. Which is not present in the female reproductive organ? (A) Penis [ ], (B)Oviduct [ ], (C) Ovary [ ], (D) Uterus [ ].
13. The release of one ova every month in females is called…(A) Menstruation [ ], (B) Ovulation [ ], (C) Copulation [ ], (D) Excretion [ ]

14. Organs called urino-genital in functions are because …. (A) They serve as excretory and reproductive in functions [ ], (B) Circulatory and reproductively [ ], (C) Excretory and respiratory [ ], (D) Reproductory and sense organ [ ].
15. The process whereby the spermatozoa fuse with the ova to form a zygote is called…..… (A) Ovulation [ ], (B) Reproduction [ ], (C) Menstruation [ ], (D) Fertilization [ ]
16. Fertilization occurs in…… (A) Ovary [ ], (B) Testis [ ], (C) Fallopian tube [ ], (D) Womb [ ].
17. Which of the following undergoes incomplete metamorphosis… (A) Housefly [ ], (B) Cockroach [ ], (C) Butterfly [ ], (D) Mosquito [ ]
18. Cockroaches lay and store their legs in structures called…….(A) Purse [ ], (B) Cocoon [ ], (C) Nymph [ ], (D) Egg case [ ]
19. Throxine is important in the reproduction process in one of the following …. (A) Housefly [ ], (B) Man [ ] (C) Toad [ ], (D) Birds [ ].
20. Reproduction in toad is…… (A) Internal [ ], (B) External [ ], (C) Bisexual [ ], (D) Meta-sexual [ ].
21. Seasonal migration is a courtship behavior with…. (A) Birds [ ], (B) Reptile [ ], (C) Amphibian [ ], (D) Cockroaches [ ]
22. The male sex gamete in the flowering plant is…. (A) Ovule [ ], (B) Ovary [ ], (C) Pollen grain [ ], (D) Filament [ ]
23. The part of the flower that attracts pollinators is called… (A) Sepal [ ], (B) Calyx [ ], (C) Corolla [ ], (D) Pedical [ ].
24. One of the following is a drupe …… (A) Okra [ ], (B) Orange [ ], (C) Tomatoes [ ], (D) Coconut [ ],
25. One of the following is disposed by explosive mechanism……... (A) Rubber [ ], (B) Coconut [ ], (C) Mango [ ], (D) Maize [ ]
26. Ovule in the flower is contained in… (A) Filament [ ], (B) Anther [ ], (C) Ovary [ ], (D) Receptacle [ ].
27. An example of a dehiscent fruit is ..... (A) Crotalaria [ ], (B) Tomatoes [ ], (C) Mango [ ], (D) Orange [ ]
28. In the flowering plants, fertilization would occur when…… (A) The pollen grows downwards penetrating the style [ ], (B) A pollen grains is transferred to the stigma [ ], (C) One of the nuclei inside the pollen tube fused with the ovum [ ], (D) The nucleus of the pollen tube divides [ ]
29. What is the function of the stigma? (A) Attraction of insects [ ], (B) Secretion of nectar [ ], (C) Production of the stigma [ ], (D) Formation of fruit [ ].
30. Wind pollinated flowers usually have…. (A) Rough pollen grain [ ], (B) Stricky stamens [ ], (C) Small and short stigma [ ], (D) Long style [ ].

Model Answers

Students Achievement Test

Pre-test

1. D
2. C
3. B
4. D
5. B
6. A
7. B
8. A
9. B
10. C
11. C
12. A
13. B
14. A
15. D
16. C
17. B
18. B
19. C
20. B
21. A
22. C
23. C
24. C
25. A
26. C
27. C
28. C
29. A
30. B

APPENDIX XII

Students Biology Achievement Test

(SBAT)

SECTION A

INSTRUCTIONS: Answer all questions from this section mark (√) from the option A – D provided against each question.

POST-TEST

Name of Student:……..…….
Name of School:……
Sex:……
Group:……
TIME: 1 Hour

1. What is the function of the stigma? (A) Attraction of insects [ ], (B) Secretion of nectar [ ], (C) Production of the stigma [ ], (D) Formation of fruit [ ].
2. Wind pollinated flowers usually have…. (A) Rough pollen grain [ ], (B) Stricky stamens [ ], (C) Small and short stigma [ ], (D) Long style [ ].
3. Cockroaches lay and store their legs in structures called…….(A) Purse [ ], (B) Cocoon [ ], (C) Nymph [ ], (D) Egg case [ ]
4. Organs called urino-genital in functions are because …. (A) They serve as excretory and reproductive in functions [ ], (B) Circulatory and reproductively [ ], (C) Excretory and respiratory [ ], (D) Reproductory and sense organ [ ].
5. An example of a dehiscent fruit is ..... (A) Crotalaria [ ], (B) Tomatoes [ ], (C) Mango [ ], (D) Orange [ ].
6. Which of the following undergoes incomplete metamorphosis… (A) Housefly [ ], (B) Cockroach [ ], (C) Butterfly [ ], (D) Mosquito [ ]
7. The male sex gamete in the flowering plant is…. (A) Ovule [ ], (B) Ovary [ ], (C) Pollen grain [ ], (D) Filament [ ]
8. In the flowering plants, fertilization would occur when…… (A) The pollen grows downwards penetrating the style [ ], (B) A pollen grains is transferred to the stigma [ ], (C) One of the nuclei inside the pollen tube fused with the ovum [ ], (D) The nucleus of the pollen tube divides [ ]
9. One of the following is a drupe …… (A) Okra [ ], (B) Orange [ ], (C) Tomatoes [ ], (D) Coconut [ ],
10. Reproduction in toad is…… (A) Internal [ ], (B) External [ ], (C) Bisexual [ ], (D) Meta-sexual [ ].
11. Ovule in the flower is contained in… (A) Filament [ ], (B) Anther [ ], (C) Ovary [ ], (D) Receptacle [ ].

12. Which of the following is responsible for the sensation of touch? (A) Hands [ ], (B) Skin [ ], (C) Ear [ ], (D) Olfactory [ ]
13. Throxine is important in the reproduction process in one of the following ….
(A) Housefly [ ], (B) Man [ ] (C) Toad [ ], (D) Birds [ ].
14. A girl is feeling very cold, this means her…….is functioning properly. (A) Corsides in the skin [ ], (B) Clothes [ ], (C) Eye [ ], (D) Cochlea [ ]
15. Which is not present in the female reproductive organ? (A) Penis [ ], (B) Oviduct [ ], (C) Ovary [ ], (D) Uterus [ ].
16. The release of one ova every month in females is called…(A) Menstruation [ ], (B) Ovulation [ ], (C) Copulation [ ], (D) Excretion [ ]
17. The process whereby the spermatozoa fuse with the ova to form a zygote is called…..…
(A) Ovulation [ ], (B) Reproduction [ ], (C) Menstruation [ ], (D) Fertilization [ ]
18. The cochlea is situated in. (A) Brain [ ], (B) Outer ear [ ], (C) Inner ear [ ], (D) Middle ear [ ]
19. Fertilization occurs in…… (A) Ovary [ ], (B) Testis [ ], (C) Fallopian tube [ ], (D) Womb [ ].
20. A person had an accident that affects the skull but not the nose and later lost the sense of smell. The accidents must have affect the: (A) Nose of extension [ ], (B) Olfactory lobes of the brain [ ], (C) Passage from the nose to the brain [ ], (D) Part of the skull near the nose [ ]
21. Seasonal migration is a courtship behavior with…. (A) Birds [ ], (B) Reptile [ ], (C) Amphibian [ ], (D) Cockroaches [ ]
22. Balancing is one of the functions of the (A) Tongue [ ], (B) Legs [ ], (C) Hands [ ], (D) Ear [ ]
23. A boy drinks, a bottle of coke and complains of bitterness, obviously he has a problem with his (A) Nose [ ], (B) Taste buds [ ], (C) Mouth [ ], (D) Teeth [ ]
24. The outermost part of the mammalian ear is called? (A) Middle ear [ ], (B) Eustachian tube [ ], (C) Pinna [ ], (D) Auditory cornal [ ]
25. The part of the flower that attracts pollinators is called… (A) Sepal [ ], (B) Calyx [ ], (C) Corolla [ ], (D) Pedical [ ].
26. Myopia is a defect of the. (A) Ear [ ], (B) Eye [ ], (C) Tongue [ ], (D) Skin [ ]
27. One of the following is disposed by explosive mechanism……... (A) Rubber [ ], (B) Coconut [ ], (C) Mango [ ], (D) Maize [ ]
28. Semi circular canals are found in the (A) Ear [ ], (B) Tongue [ ], (C) Nose [ ], (D) Skin [ ]
29. Spermatozoa are the sex gamete for…… (A) Female [ ], (B) Old women [ ], (C) Male [ ], (D) Reproduction [ ]
30. Ability of the human eye to focus images accurately on the retina is called …….
(A) Astigmatism [ ], (B) Myopia [ ], (C) Adjustment [ ], (D) Accommodation [ ]

Model Answers

Students Achievement Test

Post-test

1. A
2. B
3. B
4. A
5. C
6. B
7. C
8. A
9. C
10. B
11. C
12. B
13. C
14. A
15. A
16. B
17. D
18. C
19. C
20. B
21. A
22. D
23. B
24. C
25. C
26. B
27. A
28. A
29. C
30. D

APPENDIX XIII

Students Biology Achievement Test

(SBAT)

SECTION A

INSTRUCTIONS: Answer all questions from this section mark (√) from the option A – D provided against each question.

DELAYED TEST (RETENTION TEST)

Name of Student:……..…….
Name of School:……
Sex:……
Group:……
TIME: 1 Hour

1. Myopia is a defect of the. (A) Ear [ ], (B) Eye [ ], (C) Tongue [ ], (D) Skin [ ]
2. A girl is feeling very cold, this means her…….is functioning properly. (A) Corsides in the skin [ ], (B) Clothes [ ], (C) Eye [ ], (D) Cochlea [ ]
3. Which of the following is responsible for the sensation of touch? (A) Hands [ ], (B) Skin [ ], (C) Ear [ ], (D) Olfactory [ ]
4. Balancing is one of the functions of the (A) Tongue [ ], (B) Legs [ ], (C) Hands [ ], (D) Ear [ ]
5. Wind pollinated flowers usually have…. (A) Rough pollen grain [ ], (B) Stricky stamens [ ], (C) Small and short stigma [ ], (D) Long style [ ].
6. A person had an accident that affects the skull but not the nose and later lost the sense of smell. The accidents must have affect the: (A) Nose of extension [ ], (B) Olfactory lobes of the brain [ ], (C) Passage from the nose to the brain [ ], (D) Part of the skull near the nose [ ]
7. What is the function of the stigma? (A) Attraction of insects [ ], (B) Secretion of nectar [ ], (C) Production of the stigma [ ], (D) Formation of fruit [ ].
8. In the flowering plants, fertilization would occur when…… (A) The pollen grows downwards penetrating the style [ ], (B) A pollen grains is transferred to the stigma [ ], (C) One of the nuclei inside the pollen tube fused with the ovum [ ], (D) The nucleus of the pollen tube divides [ ]
9. An example of a dehiscent fruit is ..... (A) Crotalaria [ ], (B) Tomatoes [ ], (C) Mango [ ], (D) Orange [ ]
10. Ovule in the flower is contained in… (A) Filament [ ], (B) Anther [ ], (C) Ovary [ ], (D) Receptacle [ ].
11. One of the following is disposed by explosive mechanism……... (A) Rubber [ ], (B) Coconut [ ], (C) Mango [ ], (D) Maize [ ]

12. A boy drinks, a bottle of coke and complains of bitterness, obviously he has a problem with his (A) Nose [ ], (B) Taste buds [ ], (C) Mouth [ ], (D) Teeth [ ]
13. Semi circular canals are found in the (A) Ear [ ], (B) Tongue [ ], (C) Nose [ ], (D) Skin [ ]
14. One of the following is a drupe …… (A) Okra [ ], (B) Orange [ ], (C) Tomatoes [ ], (D) Coconut [ ],
15. The part of the flower that attracts pollinators is called… (A) Sepal [ ], (B) Calyx [ ], (C) Corolla [ ], (D) Pedical [ ].
16. The male sex gamete in the flowering plant is…. (A) Ovule [ ], (B) Ovary [ ], (C) Pollen grain [ ], (D) Filament [ ]
17. Seasonal migration is a courtship behavior with…. (A) Birds [ ], (B) Reptile [ ], (C) Amphibian [ ], (D) Cockroaches [ ]
18. Reproduction in toad is…… (A) Internal [ ], (B) External [ ], (C) Bisexual [ ], (D) Meta-sexual [ ].
19. The cochlea is situated in. (A) Brain [ ], (B) Outer ear [ ], (C) Inner ear [ ], (D) Middle ear [ ]
20. Throxine is important in the reproduction process in one of the following …. (A) Housefly [ ], (B) Man [ ] (C) Toad [ ], (D) Birds [ ].
21. Cockroaches lay and store their legs in structures called…….(A) Purse [ ], (B) Cocoon [ ], (C) Nymph [ ], (D) Egg case [ ]
22. Organs called urino-genital in functions are because …. (A) They serve as excretory and reproductive in functions [ ], (B) Circulatory and reproductively [ ], (C) Excretory and respiratory [ ], (D) Reproductory and sense organ [ ].
23. The release of one ova every month in females is called…(A) Menstruation [ ], (B) Ovulation [ ], (C) Copulation [ ], (D) Excretion [ ]
24. Which is not present in the female reproductive organ? (A) Penis [ ], (B) Oviduct [ ], (C) Ovary [ ], (D) Uterus [ ].
25. Spermatozoa are the sex gamete for…… (A) Female [ ], (B) Old women [ ], (C) Male [ ], (D) Reproduction [ ]
26. The outermost part of the mammalian ear is called? (A) Middle ear [ ], (B) Eustachian tube [ ], (C) Pinna [ ], (D) Auditory cornal [ ]
27. Ability of the human eye to focus images accurately on the retina is called ……. (A) Astigmatism [ ], (B) Myopia [ ], (C) Adjustment [ ], (D) Accommodation [ ]
28. Which of the following undergoes incomplete metamorphosis… (A) Housefly [ ], (B) Cockroach [ ], (C) Butterfly [ ], (D) Mosquito [ ]
29. Fertilization occurs in…… (A) Ovary [ ], (B) Testis [ ], (C) Fallopian tube [ ], (D) Womb [ ].
30. The process whereby the spermatozoa fuse with the ova to form a zygote is called…..… (A) Ovulation [ ], (B) Reproduction [ ], (C) Menstruation [ ], (D) Fertilization [ ]

Model Answers

Students Achievement Test

Delayed test (Retention)

1. B
2. A
3. B
4. D
5. B
6. B
7. A
8. C
9. C
10. C
11. A
12. B
13. A
14. C
15. C
16. C
17. A
18. B
19. C
20. C
21. B
22. A
23. B
24. A
25. C
26. C
27. D
28. B
29. C
30. D