

**IMPROVING STUDENTS' ACHIEVEMENT AND INTEREST IN
BIOLOGY: THE USE OF PEER TUTORING**

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(BIOLOGY EDUCATION)
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TITLE PAGE

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**A MASTERS PROJECT SUBMITTED TO THE DEPARTMENT OF
SCIENCE EDUCATION, FACULTY OF EDUCATION, IN FULFILMENT
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IN SCIENCE EDUCATION (BIOLOGY)**

SUPERVISOR: PROF. U. M. NZEWI

SEPTEMBER, 2019

APPROVAL PAGE

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DEDICATION

This project is dedicated to my mother Mrs. Pauline Ihekwoaba, for her encouragement and inspiration throughout the period of this study.

ACKNOWLEDGMENT

The researcher is very grateful to Almighty God for sustaining her immensely throughout the period of this work. The researcher sincerely expresses her unreserved gratitude to her supervisor, Prof. U. M. Nzewi who in spite of her very tight schedules always found time to read through the work, continued encouraging her and giving constructive criticisms. It was her unique method of motivation when progress seemed possible that ensured the completion of this work. The researcher is also grateful to her mother Mrs. Pauline, brother Udochukwu and sister Oluebube for their prayers, supports towards the accomplishment of this work successfully. To the researcher's uncles Ven. Edison Okoroigwe and wife, Eng. Dr. Edmond Okoroigwe and wife, Ven. Dr. Augustine Amaeze and wife, the researcher owes immeasurable gratitude for their prayers, encouragements and supports.

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ABSTRACT

The purpose of the study is to determine the effects of peer tutoring on students' achievement and interest in Biology. The study used two modes of peer tutoring such as Whole Class Peer Tutoring (WCPT) and Reciprocal Peer Tutoring (RPT). To guide the study, six research questions were posed and six hypotheses were formulated and tested at 5% probability level. Quasi-experimental design was adopted for the study. Specifically, pretest- posttest non-equivalent control groups design was used for the study. The study was carried out in Onitsha Education Zone of Anambra State. Six out of the 32 co-educational schools in Onitsha education zone were used for the study. A total sample of one hundred and eighty (180) SSII Biology students of 2018/2019 section was used for the study. The sample was drawn using stratified random sampling and simple random sampling techniques. Two instruments, a Biology Achievement Test (BAT) and a Biology Interest Scale (BIS) were used for data collection. The BAT consist of 30 multiple choice test items which were drawn from the content covered which include; adaptation, conservation of natural resources, pollution and its control and association. The BIS consist of 16 items which sought to measure students' interest in Biology. The instrument was trial tested on 30 students, the reliability of BAT was determined using Kuder-Richardson (K-R20) and yielded an internal consistency index of 0.83. The BIS yielded an internal consistency index of 0.82 using Cronbach Alpha. Mean and Standard deviation were used in answering the research questions while Analysis of Covariance (ANCOVA) was used in testing the null hypotheses. The findings, among other things showed that there was a significance different in the mean achievement score of students taught Biology using WCPT than those taught with RPT. In line with the findings of the study, the educational implications of the findings were highlighted and recommendations were proffered, which include that Biology teachers should be exposed to relevant and effective pedagogy involving the use of WCPT strategy in teaching biology.

CHAPTER ONE

INTRODUCTION

Background to the Study

Science is the study of nature. Science can be defined as a dynamic and objective process of seeking knowledge, an enterprise involving people searching, investigating and seeking verification of natural phenomena. Hazim (2015) defined science as a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. This view justifies the fact that science revolves about organization of knowledge, in terms of giving clear focus on activities in universe which can come in terms of acquisition of a particular knowledge or teaching. Igwe (2003) defined science as a systematic study of the nature, behavior of the material and physical universe through observation, experimentation, measurement and recording. Taking positions from Hazim and Igwe, it can be deduced that science involves a systematic and precise way of seeking knowledge about the universe. In contrast to the above views, Iwuozor (2000) observed that science is an area of learning, which enhances a nation's development and progress especially in the area of automation by virtue of its numerous values of humanity. Yogesh (2015) also, defined science as the pursuit, application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence. Seeing from the above definitions of science, there is no gainsaying the fact that science is an integral part of human society, and its impact is felt on every aspects of human life. This is owing to its fundamental benefits to educational development of any nation and has become a subject for teaching in schools. Science covers various subjects such as Physics, Chemistry, Mathematics, Basic science, Agriculture and Biology.

Biology is a branch of science that deals with the study of living things. It is a branch of natural science that deals with the study of living organisms, the structures, functions, evolutions, distribution and interrelationships. Biology is the study of living things and their vital processes which deals with physiochemical aspect of life (Kara, 2019). This includes medicine, forestry, agriculture, biotechnology, nursing and other biology related courses. It is taught in senior secondary schools as one of the science subjects stipulated in the National Policy of Education. Ofegbu (2013), noted that Biology has a large student enrolment than any other science subject at the senior secondary school. The study of biology in senior secondary schools is expected to prepare the students to acquire: Adequate laboratory and field skills in biology; Meaningful and relevant knowledge in biology; Ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture; Reasonable and functional scientific attitude (Federal Ministry of Education [FME], 2004;p.i). These objectives, when properly harnessed will foster acquisition of knowledge, skills and desirable attitudes germane for personal and societal development. However, it appears that students are yet to fully gain from those objectives resulting in their poor achievements in biology external and internal examinations.

This is captured in the West African School Certificate Examination (WASCE) as reported by West African Examination Council (WAEC) chief examiners report (2015) (See Appendix A, p. 83). Also Auwalu, Muhammad and Mohd (2014); Adewale, Ogunshola and Nzewuihe (2016), maintained that there is poor achievement of students in biology. In a quest to unravel the reasons behind this poor achievement, Akinsanyo and Ajayi (2014) noted that parents' education has the highest significant influence on the academic achievement of students in sciences. Also, Komba (2013) identified the following factors as causes of poor achievement of students in biology such as lack of teachers, unconducive teaching and learning environment

and poor teaching and learning materials. Diaanh (2013) pointed out that the poor achievement of students may be due to poor coverage of biology textbooks, lack of interest among biology students and inadequate laboratory facilities.

The most important factor believed to influence students' achievement in science and other subjects has remained the teacher, teaching methods and strategies used (Cimer, 2015). This is because teachers can use their occupational skills to manipulate all other factors and channel them towards enhancing student's participation, interest and achievement in the subject. Research finding showed that most biology teachers are still struggling on how to effectively utilize some teaching methods and strategies identified to be effective through research in biology education (Capa, 2012). Majority of biology teachers still adopt conventional methods of instruction such as lecture method, where the teacher does most of the talking during the teaching and learning process, instead of using the instructional methods and strategies that have been pointed out as being effective in improving student's achievement and interest. Among the methods reported to be effective is constructivist method (Ibe, Nwosu, Obi & Nwoye 2016). Constructivism is the process by which students construct their own understanding by reflecting on their personal experiences, and by relating the new knowledge with what they already know. It has two major types such as cognitive and social constructivism. Cognitive constructivism focuses on mental processes rather than observable behavior. But for the purpose of this study, the main focus is on social constructivism which refers to the process in which peers conceptualize ideas and thoughts through interaction with other peers and the teacher guides the activities of peers in a social way (Prowel & Kalina, 2009). Constructivism and its implications in the classroom, the practices have succeeded in changing the narrative about absolute influence of teacher in bringing about learning to occur on the students. This is because constructivism lays

great premium on the fact that for students to learn, the students must be seen doing something personally in order to learn. The students are expected to be actively involved in the learning process with the teacher acting as a facilitator of learning. With the emergence of the theory of constructivism, greater attention has been focused on the dynamics of interaction within the classroom. Some of these dynamics include the need to articulate and bring into form the role of the teacher in the class, the critical role of students in determining not only how best to learn, but what the students need to do in order to learn meaningfully. Students' interaction has also been identified as a viable means of enabling students learn and be able to construct their own learning. It is in this sense that attention in research has turned to peer tutoring.

Peer tutoring is an instructional strategy that consists of pairing students together to learn or practice an academic task. It can also be regarded as the process between two or more students in a group, where one of the student's acts as a tutor for the other group-mate (s). Paul (2006) defined peer tutoring as an instructional strategy that partners students to help one another learn material, reinforce skill or practice a learned task. Conrad (2008) viewed peer-tutoring as an organized learning experience in which one student serves as the teacher or tutor, and one is the learner or tutee. Peer tutoring gives students an opportunity to use their knowledge in a meaningful and social experience. In this same vein Howard, Heron, Ellis and Cooke (1986) asserted that tutors reinforce their own learning by reviewing and reformulating their knowledge. Tutees gain one-on-one attention and both tutors and tutees gain self-confidence. There are mainly two types of peer tutoring, namely, incidental peer tutoring (IPT) and structured peer tutoring (SPT). Incidental peer tutoring often takes place, either at school or while students are playing after school or when they are socializing. Whenever children are cooperating, playing or studying and one guides the others, such is regarded as incidental peer

tutoring. Structured peer tutoring on the other hand refers to peer tutoring implemented in specific cases and for specific subject, following a well-structured plan prepared by the teacher. Structured peer tutoring is usually used by experienced teachers who are able to plan well in advance and are familiar on how to combine tutors and tutees appropriately in order to have good result. Varieties of the SPT exist, these include Cross-Age Peer Tutoring (CAPT), Peer Assisted Learning Strategies (PALS), Reciprocal Peer Tutoring (RPT), same- Age Peer Tutoring (SAPT) and Class Wide Peer Tutoring (CWPT) (Peter, 2016).

Cross-Age peer tutoring refer to peer tutoring in which the elder students act as tutors while the younger students act as tutees (Robinson, Schofield & Steers-Wentzell, 2005). Peer Assisted learning strategy, explains the use of high performing students to help or teach low performing students in a particular subject area. Reciprocal peer tutoring refer to peer tutoring in which students in each group plays an alternate role in the cause of teaching and learning process that is, they take turns during the process (Fauntuzzo, Heggie & Clement 1984). Same-Age peer tutoring involves pairing students who are of the same age bracket to serve as tutors or tutees (Topping 2005). Class wide peer tutoring involves dividing the entire class into groups of two to five students with differing learning ability levels in the process of teaching and learning (Greenwood, Delguardi & Hall 2008). In this study, Class Wide, Peer Tutoring is also known as Whole Class Peer Tutoring (WCPT). Despite the variations that exist among peer tutoring instructional strategies, the underlying theory is that peer interaction can have consistent and powerful influence on the academic achievement of students (Sternberg, 2006).

Therefore, for the purpose of this study, Whole Class Peer Tutoring (WCPT) and reciprocal peer tutoring (RPT) were adopted. In WCPT, the entire class is divided into pairs or small groups of two to five students with differing ability levels where the entire classroom of

students is actively engaged in the process of learning and practicing basic academic skills simultaneously in a systematic and fun way (Greenwood et al. 2008). Those students with high ability level which was gotten from the pretest, serves as tutors or leaders while other students' serves as tutees to other students. This involves highly structured procedures, direct rehearsals and competitive teams. While RPT involves grouping of students into two or more groups and the students alternates the roles of tutors and tutees in a group. The students work together to prompt, monitor, and evaluates each other, while working towards group goals. In spite of the relevance of WCPT and RPT, studies are yet to be conducted on determining the effects of WCPT and RPT in improving students' achievement and interest in biology in Onitsha education zone of Anambra state.

Achievement means anything somebody has done successfully using his or her own effort and skill. Yusuf (2005), sees achievement as a measurable behavior in a standardized series of test. Achievement can be reached in different aspects in life such as manufacturing, business, economy and education. Achievement is described as something students obtain at school, college or university, in class, in laboratory, library or field work. It is also referred to as the change in behavior exhibited at the end of a given period of time or within a given range of time. Academic achievement is commonly measured by examinations or continuous assessment but there is no general agreement on how best it can be measured since there are some variations in the teaching methods and strategies employed by teachers. Studies by Cakiroglu and Telli, (2012); and Capa, (2012) have shown that strategies of instruction can affect students' achievements. Teaching strategies do not only enhance the achievement of learners, but may affect the interest of the students in learning any subject.

Interest means showing mostly positive feelings towards a particular thing. Habor-Peters (2011) viewed interest as a subjective attitude, concern or condition involving a precept or an idea in attention and combination of intellectual and feeling of consciousness based on native curiosity, conditioned by experience. Also Nna, (2016) viewed interest as a state of mental and emotional readiness on the part of the students to respond to an educational situation in a manner that gives first place to the interest of the society and profession. Obodo (2015), described interest as the attraction which forces or compels a child to respond to a particular stimulus. It could be considered as the feeling of an individual towards a particular object or activity. It means that a child will develop interest in any object or activity that is found to be attractive or stimulating to him / her. Some studies showed that interest affects students' performance in science while other studies were on the contrary. For example the study conducted by Okoro (2011) found that interest affects student's interaction pattern in physics; in a study conducted by Abanikannda (2018) found out that the use of technology tools affects students interest in biology. While a study conducted by Agwagah (2003) found that interest does not affect students reading instruction in mathematics. Hence there is no consensus on students' interest in sciences; therefore the need for this study to find out if peer tutoring (WCPT and RPT) can help to improve students' interest in biology. Students' interest is also likely to be influenced by gender.

Gender is a set of characteristics distinguishing between males and females as assigned by the society. According to Okeke (2004), gender is a social or cultural construct, characteristics, behavior and roles that vary from place to place or culture to culture. It is not like sex, which is biologically and universally determined. Also in the same vein, Ekeh (2000) defined gender as a socio-cultural construct that assigns roles, attitudes and values considered appropriate for each sex. Ekeh (2000) maintains further that gender implies the character of

being male or female, man or woman, boy or girl. Some of the roles played are imposed on them by the society. This being the case, members of the society, children inclusive believe that there are certain roles that are not for them to play. One of such roles is active participation in some affairs of the society. Gender issue seems to affect students' performance in sciences and biology particularly. Some studies show that girls perform more poorly in sciences than boys while other studies were on the contrary. For examples the study conducted by Madu (2004) and Agomuoh (2010) found that gender influences students' conceptual shift in physics in favor of male students; while a study conducted by Calsambis (2007) found that students achievement in science especially in the acquisition of formal reasoning schemata was in favor of girls. Nwosu (2001) found that students' achievement in science especially in the acquisition of science process skills was not gender specific. And Azman, Kamarudin & Maaulot (2018) found out that male students performed better than female students in biology among the Malaysian foundation gifted students. In essence, it could be seen from those studies that the issue of gender is yet to be resolved particularly as regards to student's achievement and interest in science especially in biology. Could the use of peer tutoring therefore be effective in improving students' achievement and interest, gender notwithstanding?

Statement of the Problem

The fact that there are large students' enrolment in biology, students' achievement in the subject is poor. Student's achievement in Biology in internal and external examinations is on the decline as stated by WAEC Chief Examiner (2015). This poor achievement in biology could be attributed to so many factors such as poor classroom management, lack of adequate instructional materials, lack of adequate laboratory activities, lack of interest among the students, poor teaching methods and strategies employed in teaching biology by the secondary school teachers

and lack of competent biology teachers. Biology as a subject is vast and activity based; it therefore needs a powerful teaching method and strategies that can take care of learning styles and ability levels of the students. In order to overcome the problems of poor achievement and interest by students in biology, some researchers have suggested the use of diverse instructional strategies which may be of help. Such strategies include constructivist approach and computer assisted instructions. Could peer tutoring instructional strategy of social constructivism approach therefore be effective in improving students' achievement and interest in Biology? Students' centered methods and strategies have traditionally giving more credence to hands on activity while the aspect of changing dynamics in peer interaction remained ignored. It is for this purpose this study is conceived. Peer tutoring (WCPT and RPT) opens up the avenue need to employ further the inherent benefit.

Purpose of the Study

The purpose of the study is to determine if student's achievement and interest in biology can be improved using peer tutoring. Specifically, the purpose of the study is to investigate the:

1. achievement of students in biology when exposed to RPT strategy and those exposed to WCPT strategy.
2. interest of students in biology when exposed to RPT strategy and those exposed to WCPT strategies.
3. achievement of male and female students in biology.
4. Influence of gender on student's interest in biology.

5. interaction effect of instructional strategies and gender on students' achievement.
6. interaction effect of instructional strategies and gender on students' interest.

Significance of the Study

The findings of this study have both theoretical and practical significance. Theoretically, the findings of this study support the tenets of Vygostky's social constructivist theory and Bruner's constructivist learning theory. Vygostky's theory emphasizes on the collaborative nature of learning. According to Vygostky (1978), every function on the child's (cultural) development appears twice, first on the social level and later on the individual level. The importance of Peer learning was emphasized in the development of the notion of the Zone of Proximal Development (ZPD). Vygostky defined ZPD as the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or collaboration with more capable peers. Vygostky concluded that peer interaction in the learning process was essential to allow internalization and long-term cognitive growth. The peer questions, discusses, debates and extends the thinking to their partners. This theory relates to this study because, in peer tutoring teaching method, students do the teaching by themselves. As such they socialize with one another and also students were grouped based on their ability levels such as high, low and average in a group taking care of individual level.

Bruner's (1966) theory of learning is called discovery learning. This theory believes that learning does not occur as a result of perceptions of events that happen to the learner but rather occurs as a result of learner's construction of perception (both emotional and intellectual) into

schema upon which concepts are organized and net worked. This theory postulates that learning could be enhanced when the learner is engaged in the teaching learning process towards self-discovery of facts. Human cognition develops as the individual interacts with the environment and explores it. Consequently, teaching could be enhanced through engaging the learners on the task(s) that will enable them to internalize every bit of the material being learnt for improved achievement. Bruner's ideas about learning are related to peer tutoring approach since both requires active participation of the learner. Bruner pointed out that a learner actively constructs his knowledge by relating new content being learnt to previously acquired information as well as uses his information in future circumstances. This can equally be applied to peer tutoring strategy since students' needs to basically construct their knowledge about a concept to be learnt by relating it to their previous knowledge so that they can teach the concept effectively to other students.

The findings of the study are expected to be of practical significance to biology teachers, students, curriculum planners and researchers. To biology teachers, the findings would help teachers to carry the students along, that is cater for the individual differences in the classroom by taking care of learning disabilities in the classroom. This is because students are grouped based on their ability levels such as high, average and low in a group. Also the findings would equally make Biology teachers to be flexible in changing their teaching strategies to suit the needs of learners at a particular period, thus, making teaching and learning of Biology to be student-centered instead of teacher centered.

Further more to the students, the findings would be of great help to them in acquiring collaborative skills, become creative, self-mediating and have confidence in themselves since they are the ones to do the teaching. The activity oriented nature of peer tutoring generally for

instance could help the students in organization of incoming information; build mental bridges between what was already known and what would be learnt. It could also promote permanency in learning, this is because the concept to be learnt becomes clearer to them as they interact or teach themselves, thereby increasing achievement of students.

To the curriculum planners, the findings of this study, if published would help them to integrate peer tutoring teaching strategy especially WCPT in biology curriculum for the use of teachers. The findings of this study could provide information to the Teacher-Training intuitions such as Colleges of Education on the need to incorporate WCPT strategies into their course and programs and it could also help curriculum planners to organize free seminars, conferences and workshops for their lecturers on how to teach them to students.

Finally, the result of this study is expected to provide empirical evidence on the efficacy of peer tutoring instructional strategy on senior secondary school students' achievement and interest in Biology. This could form a basis for further research in Biology education also it could serve as empirical evidence to other researchers.

Scope of the Study

The study was carried out in Onitsha Education zone of Anambra state. The reason for the selection of this state is to enhance easy monitoring of the study by the researcher. The study used SS II biology students. The justification for using SSII students is because they have enough foundation in biology; this means they are matured academically to discuss intensive issues in biology and also the topics fall within their biology core curriculum. Four broad topics pollution and its control, conservation of natural resources, adaptation and association drawn from the senior secondary school biology curriculum for SSII level were used. The reason for the

use of the above topics is because knowledge of pollution and its control, adaptation, associations well as students' exposure to conservation of natural resources would help to ensure environmental sustainability, which is among the goals of sustainable development.

Research Questions

The following research questions guided the study.

- 1) What are the mean achievement scores of students in biology when exposed to RPT strategy and those exposed to WCPT strategy?
- 2) What are the mean interests scores of students in biology when exposed to RPT strategy and those exposed to WCPT strategy?
- 3) What are the mean achievement scores of male and female students in biology?
- 4) What are the influence of gender in students' interest in biology?
- 5) What are the interaction effect of instructional strategies and gender on students' achievement?
- 6) What are the interaction effect of instructional strategies and gender on student's interest?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance

- HO₁:** There is no significant difference in the mean achievement scores of students in biology when exposed to RPT and those exposed to WCPT strategies.
- HO₂:** There is no significant difference in the mean interest scores of students in biology when exposed to RPT and those exposed to WCPT strategies

- HO₃:** There is no significant difference in the mean achievement scores of male and female students in biology.
- HO₄:** There is no significant difference in the mean interest scores of male and female students in biology.
- HO₅:** There is no significant interaction effect of instructional strategies and gender on students' achievement in biology.
- HO₆:** There is no significant interaction effect of instructional strategies and gender on students' interest in biology.

CHAPTER TWO

REVIEW OF LITERATURE

This chapter presents literature related to the present study under the following headings:

Conceptual Framework

- Concept of peer tutoring
Whole Class Peer Tutoring (WCPT)
Reciprocal Peer Tutoring (RPT)

- Interest in Biology
- Achievement in Biology
- Gender in Science

Theoretical Review

- Vygotsky's (1978) Social Constructivism Theory of Learning
- Bruner's (1966) Constructivism Theory of Learning

Other Related Subthemes

- Cross Age Peer Tutoring
- Same Age Peer Tutoring
- Peer Assisted Learning Strategies

Review of Related Empirical Studies

- Studies on Peer Tutoring
- Studies on Students' Interest in Biology
- Studies on Students' Achievement in Biology
- Studies on Influence of Gender in Science

Summary of Literature Review

Conceptual Framework

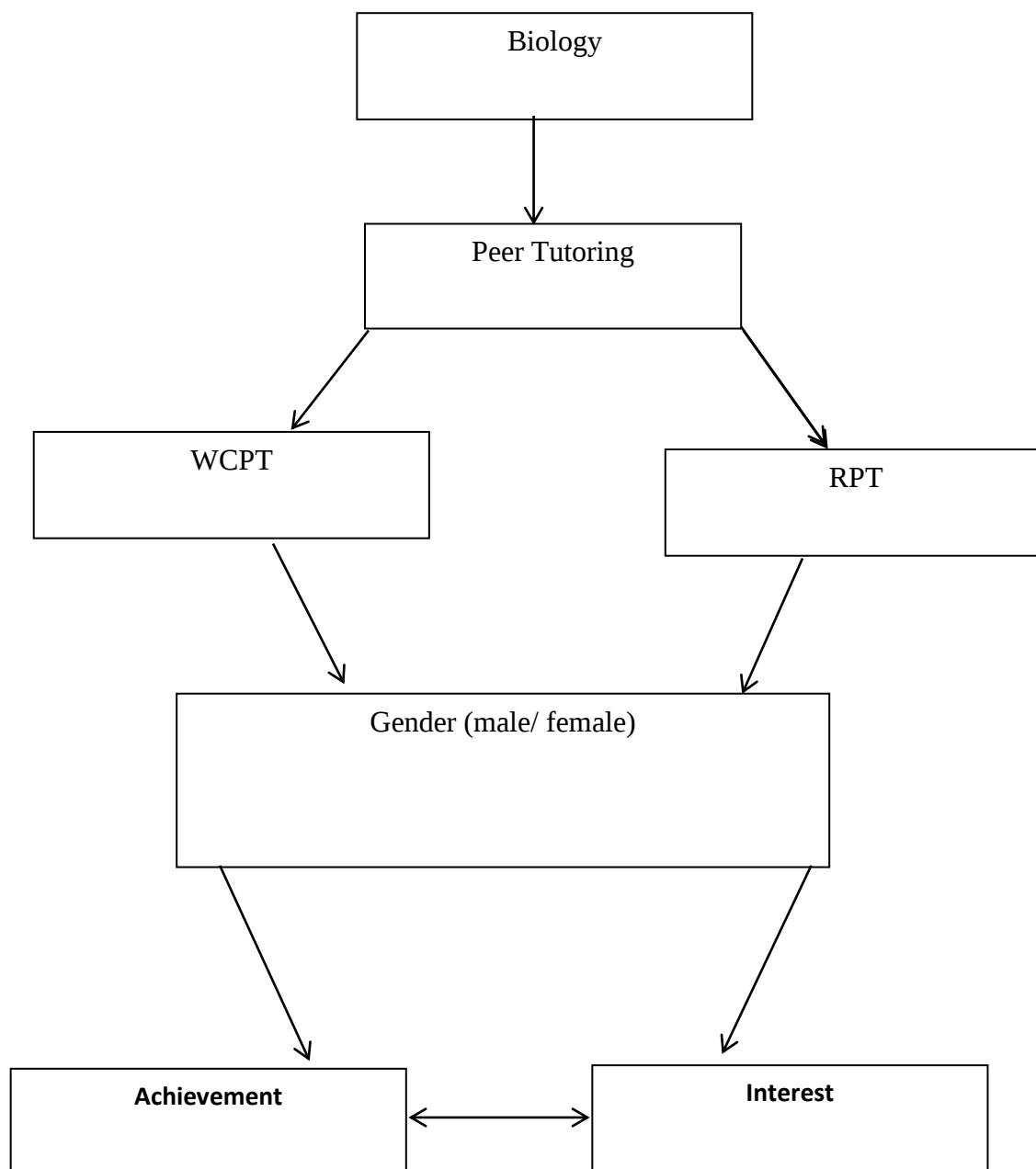


Fig 1: Schematic diagram showing the relationship between the variables in the study.

The study was carried out in biology on the influence of two modes of peer tutoring: Whole Class Peer Tutoring and Reciprocal Peer Tutoring on students' achievement and interest in

biology. WCPT and RPT are the independent variables in this study which may affect students' interest and achievement. Achievement and interest are the dependent variables which may also be influenced by gender which is the intervening variable in this study.

Concept of Peer Tutoring

The word 'peer' means a person who is equal standing with another or others, as in rank, class, age, background and social statues, while "tutor" means a private instructor, especially one who teaches a single pupil or a very small group of pupil (Honby, 2006). Peer tutoring is an instructional strategy that involves grouping students together to learn or practice an academic task. It can also be seen as the activities that take place between more than one student in a group where one of the student acts as a tutor for the other group-mate(s). Paul (2006) defined peer tutoring as an instructional strategy that encourages students to assist each other learn materials, reinforce skills or practice a giving task. In the same vein, Conrad (2007) viewed peer tutoring as a planned learning experience in which a particular student serves as the instructor or tutor, and other students' serves as learners or tutees. It gives students an opportunity to use their ability in a useful and social experience.

Peer tutoring is a flexible, peer-mediated strategy that involves students serving as academic tutors and tutees. Allen (2000) describes peer tutoring as a situation where students assists each other under a group of two or more students of different learning abilities, which the peer systematically organizes to facilitate learning capacity. The students are often assigned roles in their group for completing the task and depend on each other to learn academic material while developing stronger social skills. In the same vein Beasley (2010) defined peer tutoring as a cost-effective means of providing academic support to students through the use of valuable teaching and learning resources. This involves training peer tutors to teach other students or tutees in a

collaborative learning experience in which both parties richly benefit in various ways, including improved understanding and performance in the subject areas involved, improved confidence and study skills, as well as ongoing friendships. Dabkowski (2007) posited that peer tutoring promotes a more cooperative, pleasant classroom atmosphere, skills which students can transfer to parenting when they mature. It is also a system of instruction in which learners help each other in the process of teaching and learning. Peer tutoring enable more and less knowledgeable students speak a more similar language than the teachers. The above view is consistent with United States Agency for Interactional Development (2009) notion, that in peer tutoring unlike students- teacher relationship where instructions are only given by teachers, but in peer tutoring the more knowledgeable students is not very far removed from the less knowledgeable one in authority or knowledge, nor the more knowledgeable students have any special claim to teaching competence. This means, both the tutor and tutees are close in knowledge and status. The learner in a peer relation feels free to express his or her opinions, ask questions and answer interesting questions.

The interaction between the learner and his peers is livelier that it may improve the learning ability of the tutor and tutees. According to Hartman (2005), Peer tutoring is learning by teaching. This view is expanded in the old saying “to teach is to learn twice” Sternberg (2001) and Hartman’s (2000) theory of intelligence and performance, identifies competence which might be enhanced during peer tutoring as follows: the meta cognitive skills of planning, monitoring, evaluating and the associated use of declarative, procedural and contextual knowledge and the cognitive process of perceiving, differentiating, selecting, storing, inferring applying, combining, justifying and responding. Consequently, existing knowledge is transformed by reorganization which involves associations and new interaction that leads to

better future performance of the students concerned. Therefore, having seen the operational definitions of peer tutoring by some scholars above, the researcher defines peer tutoring as the ability of students coming together to learn, practice and participate in an academic work in a social sense.

Davis (2000, pg. 24) made the following observations about peer tutoring as follows;

- Peer tutoring increases the percentage of time spent on teaching in the class room period.
- Peer tutoring provides learners with more feedback as to their performance and provides it promptly.
- Peer tutoring increases time spent in student talk and decreases time spent in teacher talk.
- Peer tutoring enhances sense of competence and personal worth.
- Tutors are able to view the teaching/learning situation from the teacher's position and thus are led to make the classroom environment more co-operative, less suppressive and authoritarian.
- Tutors are able to identify problems of learning and adjustment that have been overlooked by teachers.

Two main types of peer tutoring exist, namely, Incidental Peer Tutoring (IPT) and Structured Peer Tutoring (SPT). Incidental peer tutoring often takes place whenever children are cooperating, playing or studying and one guides the activities of the others. It can take place at school or after school. Structured peer tutoring on the other hand refers to peer tutoring carried out in a definite cases and for specific subject area, using a well-structured plan developed by the teacher. Structured peer- tutoring is spontaneously used by experienced teachers who are able to plan well in advance and are familiar on how to combine tutors and tutees appropriately in order

to have good result. Kinds of the SPT exist, these include Cross-Age Peer Tutoring (CAPT), Peer Assisted Learning Strategies (PALS), Reciprocal Peer Tutoring (RPT), Same- Age Peer Tutoring (SAPT)) and Whole Class Peer Tutoring (WCPT) (Peter, 2016). For the purpose of this study, it adopted whole class Peer tutoring and reciprocal peer tutoring. Therefore, it becomes imperative to determine the effectiveness of the two strategies on students' achievement and interest in biology.

Whole Class Peer Tutoring (WCPT)

Whole class peer tutoring programs has been researched and used since 1980 and has repeatedly demonstrated that the tutoring process increases students time on task and improves academic performance (Greenwood et al., 2008). It involves dividing the entire class into groups of two to five students with deferring learning ability levels. The students with high ability level serves as group leaders or tutors. Whole class peer tutoring provides the opportunity for students' to practice and master what they are learning and encouraging positive social interaction among students. This is mostly done in the school. Existing WCPT studies reveals the benefit of the strategy to include: effective learning of academic skills, developing social behaviors and discipline also enhancing peer relationships (Greenwood, Carta and Hall, 2008); high level achievement and competence through structured activities (Fantuzzo and Rohrbeck, 2002). Joane (2004) showed that WCPT works for all students including those who have problems of paying attention, problem of learning and problems with emotions and behavior. The success of WCPT lies mainly on its basic operational components namely:

The multi-modality format used in WCPT is the key for learning. The peers tutoring process incorporates each of the various learning modalities or styles by which children learn. The students "hear", "see" and "writes" their responses. Tapping into all of the learning

modalities, and each individual student determines his/her advantage to acquire information quickly, immediate error correction and feedback. These are the cornerstones of peer tutoring success. WCPT attempts to get at “errorless” learning by the help of the teacher stopping the tutee as soon as they say or write anything that is incorrect. This is the reason for tutees having a pre discussion class before the main teaching commences.

Built – in reinforcement. This occurs when peer tutor verbally reinforces one another for good work during tutoring, when the teacher acknowledges exceptional tutoring behaviors with dispensing bonus points during the tutoring sessions, with verbal praise when recording points, and with classroom intrinsic reinforcement for peer tutors and tutees each day. This feature provides an opportunity for students to feel good about themselves and to engage in more appropriate skills.

High mastery levels. This can be achieved by every student when the content or subject matter materials are tailor-made to fit the individual deficit of the responding student. This is done by providing more challenging work for higher achieving students, appropriate grade level materials for the average achieving students and fewer items for the lower achieving students.

Measured outcome. They are built right into WCPT program. There are weekly outcomes that are evidenced in the pre and post assessment that are given at the very beginning of every unit material to be taught, before any tutoring is done (pre assessment). This provides a solid foundation for monitoring learning and overall improvements.

Reciprocal Peer Tutoring (RPT)

This is peer tutoring that occurs in the school, and is student-initiated, as children spontaneously help their peers, mates and friends. The peer-mediated intervention can be

organized in such a way that students are assembled in a groups of two or more and are trained to work together on a specific academic task. The students take turns acting as the tutor and tutees for instruction and review of academic materials with teachers' supervision. RPT was developed and tested for children with academics needs Fantuzzo, Heggie & Clement (1984). In this procedure, students assembled in groups of two or more are trained to work together on a specific academic task. The students work together to prompt, monitor and evaluate each other, while working towards group goals (Fantuzzo, Polite & Grayson, 1990). There is an assumption that reciprocal peer tutoring has been effective in increasing academic achievement in areas of Mathematics (Fantuzzo, King & Heller, 1992) and English (Uroko, 2010). Greenwood, Carta and Maheady (1991) identified three of the basic principles underlying RPT strategies as; engagement, increasing the opportunity to respond and increasing timely feedback regarding students' responses.

Another component of RPT is the incorporation of rewards contingent upon the achievement of each group member. RPT requires each member of the group to contribute to the attainment of the goal, and ensure that no one person can be responsible for the group success. Although, previous research on RPT has generated promising results, it has several limitations. Firstly, teachers may not consistently carry out their roles in RPT with sufficient accuracy to ensure positive outcomes, lack of support and resources and limited time to carry out such instruction (Noelletal., 1997; Witt etal., 1997). Not withstanding the variations that seems to occur among whole class peer tutoring and reciprocal peer tutoring instructional strategies, the rudimentary theory is that interaction of peers can have persistent and powerful influences on students' academic achievement and interest (Sternberg, 2006). Therefore, this study finds out if the two strategies ie WCPT and RPT can have influence on interest of students in Biology.

Interest in Biology

Interest can be seen as the feeling that accompanies or causes special attention to something or someone. Obodo(2015), sees interest as the attractions which forces or propels a child to quickly react to a particular stimulus. This means is regarded as the feeling of an individual towards a particular object or activity. Ifeakor (2005) perceives interest as the gain which an individual benefits from any activity. Sholahuddin (2010) describes interest as the desire for something, the object of the soul in order to achieve something desired. This illustrates that a person will not achieve inner objectives if the person does not have an interest. Smith (2002) also sees interest as an experience to be motivated by and to act towards a class of objects in a predictable manner. In line with this, HaborPeters (2002) viewed interest as a subjective attitude, concern or condition involving a precept or an idea in attention and combination of intellectual and feeling of consciousness based on native curiosity, conditioned by experience. It shows that any preference displaced when choices are available is the outcome of interest generated. In conjunction with learning activities, interest becomes a driving force to achieve the desired goals. Without the interest, learning objectives will not be achieved. This means that students learn with all the strength and soul, not only with the mind alone. Also, Lai (2007) defined interest in learning as personal preferences with regard to learning, which sometimes individuals chooses to perform a task that pleases them and this is driven by a positive psychological state that occurs during the interaction with circumstances that engenders further learning motives. According to Chen (2000), interest in learning is categorized into three namely:

- Individual interest
- Situational interest

- Psychological induced interest.

Individual interest is a relatively enduring predisposition to experience enjoyment in working with a particular subject matter. Situational interest refers to as short – lived or momentary interest about a particular subject matter and this can be accompanied by either positive or negative feelings. Psychological induced interest is a relatively enduring predisposition to re-engage in a particular class of subject matter over time.

Furthermore, Aniekwe (2006) asserted that interest from educational point of view is a motivational construct. Aniekwe further argues that it is the emotional response that sustains the individual for learning. The problem with many teachers of senior secondary school Biology could arise from the use of instructional techniques / strategies that do not sustains student's interest. One of the strongest factors affecting student's interest in Biology is the strategies of instruction adopted by teachers, which highly correlates with the perception of ineffective teaching strategies (Nwagbo, 2008). In fact, Nwagbo asserts that science teachers should make science real, interesting and enjoyable using innovative teaching strategies. An individual is normally actively involved in an activity of his or her interest. Therefore since this author, asserts that teachers should adopt instructional strategies that arouse students' interest in Biology, could peer tutoring (WCPT and RPT strategies) help in improving students' interest in biology. Hence the need to investigate if whole class peer tutoring and reciprocal peer tutoring could have any positive changes in students' achievement and interest in Biology.

Achievement in Biology

Achievement entails a thing that somebody has done successfully, especially using their own effort and skill. Academic achievement deals with the extent to which students have gained

from a particular course of instruction. Omachi (2000) asserted that academic achievement is the scholastic standing of a student's performance at a given moment. It also refers to cognitive score of learning outcome in a subject (Johnson, 2000, Shaibu & Usman, 2002). It has to do with the successful accomplishment of goal (s). The purpose of testing an achievement is to help the teacher and the students evaluate and estimate the degree of success attained in learning a given concept. Academic achievement is an interesting factor to teachers, students, parents and society at large because they are used for different purposes. Enyi (2004: pg. 41) listed out the following purposes for academic achievement as:

- It is used to identify student's growth or lack of growth in acquiring desirable knowledge, skills, attitude as social values
- It is also used to predict the general trend in the development of the teaching / learning process.
- It is used to determine the relative effectiveness of the program (teaching /learning) in terms of students behavioural output.
- It helps the teacher to determine the effectiveness of their teaching technique and learning materials.
- It helps to motivate students to learn more as they discover their progress or lack of progress in a given task.

Achievement in teaching and learning process has to do with attainment of set objectives of instruction. In biology instruction for instance, if a learner accomplishes a task successfully and attains the specified goals for learning experience, the learner is said to have achieved (Nwagbo, 2001). One of the issues at stake in education today is students' achievement measured in relation to teaching and the overall success of learning outcome. Furthermore, Hassan (2006)

pointed out that effective learning and sound academic achievement contributes to national development. Based on this, teaching of biology is meant to be done in such a way that school experience can be related to students' daily life experiences. Unfortunately, the use of inappropriate teaching strategies in Biology has contributed to poor achievement in Biology (Ominisi, 2006). Teachers have negated the practical oriented teaching approaches and strategies which are supposed to equip the students with the necessary practical skills and competencies for functional living in the society (Norom, 2009). Researches have shown that teaching strategies adopted by most science teachers is a major factor contributing to student's poor achievement in sciences including biology (Ali, 2002; Ugwu, 2004; Oguniyi & Okebukola, 2005). It should be noted that academic achievement may be affected by teaching methods and strategies adopted by teachers. Hence, the need for this study tends to investigate the effects of peer tutoring teaching strategies on students achievement and interest in biology.

Gender in Science

Gender is a broad analytical concept which draws out women's roles and responsibilities in relation to those of men. Gender and sex are related because they perform similar functions of categorizing people into male and female though gender differs because it deals more with socio-cultural classification of women and men. This classification is based on societal norms and values that define the roles men and women should play in the society. Gender roles are quite different from sex roles. Sex refers to as biological differences between male and female evidenced by the appearance of genitals (Okeke, 2007; Omotayo & Yusuf, 2002). Sex roles are purely biological, natural and God given. They cannot be changed meaning that it is hereditary. Gender roles on the other hand are determined by the society, which assigns different responsibilities to men and women. Gender roles can therefore be changed and vary over time

from community to community (Njoku 2001). The gender identity and the gender roles are what Njoku (2001) and Okeke (2007) called gender stereotyping. Gender stereotyping is the collection of commonly held beliefs and opinions about what are appropriate characteristics, behaviors and activities for males (masculine) and for females (feminine) in the society (Okeke, 2007). Alumonde (2005) defined gender as a short form of complex variable system of societal differential between male and female individuals found in a society or community. Gender can be regarded as psycho-social aspect of maleness and femaleness (Edebor, 2002). According to Akubue and Enyi (2002), gender means a psychological construct associated with either male or female, which results from social, physical, and psychological traits associated with each and all that has to do with their specific and respective roles. Emetarom (2000) defined gender as all the characteristics and the expected behavior and roles of men and women which a particular society has determined and assigned to each sex.

Gender in science education is controversial and inconclusive in determining the achievement and interest of students. Studies by Ogunleye (2002); Ezirim (2006); Okoro and Otubar (2007) showed that science achievement depends on gender. Nevertheless, Nwosu (2001) found that students' acquisition of science process skills is not gender specific. Madu (2004) and Agomuo (2010) found that gender influences students' achievement in favor of males. While another study by Lasisi and Ogunenye (2008) found that gender influences students' achievement in favor of female. Therefore, it could be seen from those studies above that the issue of gender is yet to be resolved particularly as regards to students' achievement and interest in sciences. Hence, the need for this study to also find out if gender influences students achievement in science (biology) when taught with whole class and reciprocal modes of peer tutoring.

Theoretical Review

Bruner's (1966) Theory of Instruction

Bruner's theory of learning is called discovery learning which was propounded in 1966. Discovery learning is an inquiry based constructivist learning theory that takes place in problem solving situations, where learners draw their own past experience and existing knowledge to discover facts, relationship and new truths to be learned. Bruner believed that students interact with the world by exploring and manipulating objects pondering with questions and controversies or performing experiences. As a result of the above idea, students may be more likely to remember concepts and knowledge discovered on their own. Bruner stressed that an individual is not passive or reactive organism but one who actively selects information, forms perceptual hypotheses, and at times alters the incoming information in order to achieve valued goals. Bruner's ideas about learning can be related to peer teaching approach since both require active participation of the learner.

The advantage of discovery learning is that it encourages active engagements, promotes motivation, autonomy responsibility, independence and development of creativity and problem solving skills. The implication of Bruner's theory is that teachers should deliberately create problem for the students with a purpose that they will learn the basics as they struggle with the problems. Instruction should be geared to the level of the child's cognitive functioning. Bruner identified three modes of representation in which children learn as they develop. These are enactive, iconic and symbolic modes. This research concentrates on the symbolic modes which do appear as the learner approaches adolescence. This is because, it is based on abstract system of thought when information is stored in form of a code or symbol such as language. This mode

of representation is most relevant to the study because SS2 students who are the subjects of the study belong to this category.

Vygotsky's (1978) Social Constructivists Theory of Learning

This theory was propounded in the year 1978. Social constructivism is a branch of cognitive constructivism that emphasized the collaborative nature of learning. The theory states that knowledge is not simply constructed; it is co-constructed. The teaching approach of peer-tutoring is a social constructivism learning based on Vygotsky's concept of zone of proximal development. The Zone of Proximal Development (ZPD) is the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. The level of actual development is the level that the learner has already reached and is capable of solving problem independently. The level of potential (zone of proximal development) is the level which the learner is capable of reaching under the guidance of teachers or in collaboration with peers. The learner is capable of solving problem and understanding material at this level that on its own is not capable of solving or understanding at one's level of actual development. It is the level at which learning takes place. It comprises of cognitive structures that are still in the process of maturing but which can only mature under the guidance of or in collaboration with others.

The zone of proximal development according to Vygotsky, defines those functions that have not yet matured but are currently in an embryonic stage. According to Vygotsky, children are working within their zone of proximal development when they are engaged in task that they could not do alone but can do with assistance of peers or adults. Many educators and learning researchers have found Vygotsky's social constructivist ideas about learning in its social settings.

The core concept of constructivism is that understanding and knowledge come from our interactions with environment. Studies by Bawn and Palinscar, (1989) and Graesser, Person, and Maliano (1995) suggest that communicating ideas in group setting encourages self-explanation, justification and instructional value. The study posits that through peer-tutoring, teachers and others can help students perform at higher levels than they could if they were completely on their own without the benefit from social interactions with others who are more competent.

The aim of peer-tutoring according to Vygotsky is for students to become independent, self-regulated and less teacher dependent. Furthermore, peer tutoring helps to bridge the gap between what students can do by themselves, and what they can do with guidance from others. Therefore from Vygotsky's point of view, peers could reach to their potential level of intellectual development in life under the guidance of the teacher and promote the students interest in the subject (biology).

Other Related Subthemes

Cross-Age Peer Tutoring (CAPT)

This type of peer tutoring involves a situation where the elder students' acts as tutors and they teach the younger students (Robinson et al, 2005). The tutors have a higher academic background more than the tutees. This approach is valuable for the students or learners because they get effective individual instructions and feedback from their tutor that is the elder students. On the other hand, the tutor gets valuable teaching experience from the tutee that is the younger ones during the process of teaching them. For example, a middle school student might be paired with an elementary grade student to help the younger students in an academic work.

Same-Age Peer Tutoring (SAPT)

This involves pairing students who are of the same age or grade level to learn an academic task (Topping 2005). This can be conducted among the students within the same classroom as well as students from different classrooms provided they are of the same age. Students may have similar ability levels or a more advanced student can be paired with a less advanced student. Students who have similar abilities should have an equal understanding of the content material and concepts. When pairing students with differing levels, the roles of tutor and tutee may be alternated, allowing the lower performing student to guide the higher performing student.

Peer Assisted Learning Strategy (PALS)

This is a version of class wide peer tutoring designed to supplement already knowledge in any subject area. Teachers create students pairs based on individual needs of the students. A student that needs help in a particular area is paired with a student who can best help that student in earning that content/ skill. Over time, partners change in order to address other needs.

Review of Empirical Studies

Studies on Peer Tutoring

Cahoon and Fuchs (2003) conducted a study on the effects of Peer-Assisted Learning Strategies (PALS) and curriculum-based measurement on academic achievement in Mathematics of secondary school students with disabilities in New York. The study used a quasi-experimental design. The study also used 10 classes with 92 students in grades 9 through 12 which were obtained using simple random sampling. Those in the experimental group received mathematics instruction in self-contained resource rooms using PALS instructional strategy while those in the control group received mathematics instruction in their normal class rooms

using lecture method. The experiment lasted for 15 weeks, the instrument for data collection was questionnaire and curriculum based measurement graph. Data was analyzed using ANOVA. The results showed that students who participated in PALS classroom improved in their computation mathematics skills more than those students in the baseline environment. Although no significant difference was found in the understanding of students in concepts and application of mathematics skills between the two groups. This study relates with the present study because both used peer tutoring instructional strategy but differs from the present study because it was carried out in mathematics using PALS while the present study compared the effectiveness of WCPT and RPT on student's achievement and interest in biology.

In another study conducted by Fuchs and Kazdan (1999), they examined the effects of Peer Assisted Learning Strategy (PALS) on students' literacy development and beliefs about reading in secondary level special education classrooms in New York. The study employed a quasi-experimental design on a sample of 100 students from grade 2 through grade 6 secondary school students in New York. A pre and post treatment quiz was given to the students. Those students in the experimental group were taught using PALS while the control group was taught using conventional method. The experiment lasted for 16 weeks. Data was collected using quiz and analyzed using mean and standard deviation. The result showed that students in both treatment groups grew comparably in reading fluency and they reported similar beliefs about being and wanting to become better readers. This study relates with the present study because both used peer tutoring, but differs with the present study in that it determined the effect of PALS on students' literacy development and beliefs about reading in special education while the present study determined the effects of WCPT and RPT modes of peer tutoring on students' interest and achievement in Biology.

Peter (2006) carried out a study on the effects of peer tutoring strategy on academic achievement of senior secondary school students in technical drawing in Ekiti State, Nigeria. The study adopted a quasi- experimental research design, precisely pre-test, post-test nonequivalent control group design which involved group of students in their intact classes. The population for the study was all 81 SS11 students offering technical drawing in all secondary schools in Ekiti State. The study used a purposive sampling technique. The instrument for data collection was Technical Drawing Achievement Test (TDAT), which was administered to both the experimental and control groups. The experimental group was taught using peer tutoring while the control group was taught using conventional method. Two research questions and three null hypotheses were tested at 0.05 level of significance. ANOVA was used to analyze the data. The result indicated that peer tutoring strategy was more effective in improving students' cognitive achievement than conventional teaching method. This study however, did not indicate the mode of peer tutoring instructional approach used. It relates to the present study in that the study investigated on the effects of peer tutoring generally on students' achievement. But the present study investigated on the effects of two modes of peer tutoring WCPT and RPT on students' achievement and interest in biology.

Uroko (2010) carried out a study on the effects of Reciprocal Peer Tutoring (RPT) on achievement, interested perceived self-efficacy in reading comprehension of senior secondary school students' in Obollo Afor Education zone of Enugu State. Four research questions and four null hypotheses guided the study. The study adopted a non-equivalent control group quasi-experimental design, involving one treatment and one control group. The population for the study was 1878 SS 11 students. Simple random sampling was used to select a sample size of 174 senior secondary class two students from four co-educational senior secondary schools in the

zone. In each school, one intact class was randomly selected and the intact classes were also randomly assigned to experimental and control conditions. Three instruments were used for data collection namely; Test of comprehension (TOC), Reading Comprehension Interest Rating Scale and Students Self Efficacy Rating Scale. The data obtained were analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA). The result of the findings indicated that intervention using RPT strategy significantly improved the achievement, interest and perceived self-efficacy in reading comprehension of senior secondary school students. This study is related to the present study in that both used RPT strategy in students' achievement and interest but differs from the present study in that the present study used two modes of peer tutoring such as RPT and WCPT strategies and also the study by Uroko was done in English language while the present study was done in biology.

Greenwood, Terry and Arreaga-Mayr (1992) carried out a research on Class Wide Peer Tutoring program; Implementation factors moderating students' achievement in university of Kansas. The population of students was 628 students. The experiment lasted for 4 weeks in which the students was classified into three outcome groups such as challenged/under mastery, under challenged/ mastery and under challenged / under mastery. A clinical replication design was used for the study. The instrument for data collection was checklist which has 15 items. The data collected was analyzed using standard deviation and Analysis of Variance (ANOVA). Stratified random sampling technique was used to select 100 students from the three outcome groups of students. The result of the findings showed that students in each class, made educationally important gains in spelling accuracy using CWPT strategy as robust procedures. This study is related to this present study in that both used CWPT strategy on students' achievement but differs in that the present study compared two strategies such as CWPT and

RPT on students' interest and achievement in biology while the study by Greenwood used only CWPT strategy.

Ezenwosu (2008) carried out a study on the effect of peer tutoring and conventional lecture method on students' achievement and interest in biology in Aguata Education zone of Anambra state. Four research questions and six hypotheses guided the study. The design adopted for the study was Quasi- experimental design. The population of the study was 1731 SS 11 students. The sample size was 228 students selected using stratified random sampling technique from two co-educational secondary schools in the zone. The instruments used for data collection was Biology Achievement Test (BAT) and Biology Interest Scale (BIS). In each of the two co-educational schools chosen, all arms in SS 11 which comprised of 110 students for experimental and 118 for the control group. The data was analyzed using Analysis of Covariance (ANCOVA). The result of the findings indicated that the interest scores of students taught biology using peer tutoring approach was higher than those taught biology using conventional lecture method. Also the study revealed that gender has significant effects on students' academic achievement in biology. This study is related with the present study in so many ways such as; subject, design, method of data collection and analysis but differs with the present study in that, the present study used two modes of peer tutoring such as CWPT and RPT strategies while the study by Ezenwosu was done using peer tutoring generally.

Studies on Students Interest in Biology

Ugwuadu (2011) carried out a study on effects of discourse patterns on students' achievement and interest in Biology. The general purpose of the study was to investigate the effects of selected discourse patterns on students' achievement and interest in biology when they are taught with inquiry method. Six research questions and ten null hypotheses guided the study.

The population of the study consisted of all senior secondary two (SS11) Biology students numbering 10,588 in 20 co-educational senior secondary schools in Yola Education Zone. Simple random sampling techniques were used to select a sample size of 164 SS11 students (94 males and 70 females). The research design adopted for the study was the quasi-experimental pre-test and post –text non-equivalent control group. The instrument for data collection was achievement test and biology interest scale which was administered to the students in the experimental schools. Data was analyzed using mean and standard deviation while the hypotheses were tested at 0.05 level of significance using ANCOVA. The result of the study indicated that the selected discourse patterns enhanced students' achievement and interest in biology. Furthermore, there was no significant difference in the mean achievement and interest scores of male and female students taught biology with the selected discourse patterns. There was no interaction effect between discourse patterns and gender in the achievement and interest of students taught biology using the selected discourse patterns. It is related to the present study in the areas of the subject, sampling techniques and instrument for data analyses but differs in using peer tutoring strategy which was absent in Ugwuadu's work .

In another study by Okoro (2008) on the effects of interaction pattern on students achievement and interest in Biology among secondary school students in Obollo Afor Education Zone of Enugu State. 5 research questions and 5 null hypotheses guided the study. The design of the study was quasi-experimental pre-test and post-test non-equivalent control group. The study used a population of 150 SS11 students from four schools. The sample was 60 students selected through purposive random sampling. Four single schools were used. The study also involved 3 intact classes, two classes were used as experimental group that were assigned co-operative, competitive and individualistic groups while one class was used as control group and was

exposed to no grouping. Data for the study were collected through two instruments; Biology Interest Inventory (BII) and Biology Achievement Test (BAT). Data was analyzed using mean and standard deviation, ANCOVA was used to test the null hypotheses at 0.05 level of significance. Results showed that the three interaction patterns; co-operative, competitive and individualistic patterns enhanced students achievement and interest of students in Biology. This study is related to the present study in that both of them had interest as a dependent variable but differs in that the present study used two modes of peer tutoring such as WCPT and RPT strategies which was absent in Okoro's work.

Abonyi (2002) conducted a study on the effects of an ethno science-based instructional package on students' interest in science in Nsukka local government area of Enugu state, with 243 secondary school science students. Ethno- science is the use of materials in one's local environment and culture. Three research questions and three null hypotheses tested at 0.05 level of significance guided the study. The design of the study was quasi-experimental of pre-test post-test non-equivalent control group design. The sample of the study comprised 243 junior secondary 111 students (JSS111) drawn from six secondary schools by simple random sampling technique. Out of the six schools, three schools (one male, one female and one coeducational school) were assigned the treatment group while the remaining three schools were the control group. The instrument for data collection was an Integrated Science Scale (ISC). The ethno-science based package was used to teach the treatment group while the conventional package was used for the control group. Pre-test was given to both groups before the onset of the experiment. After pre-test, the regular Instructional Technology Specialist (ITS) teachers started the experiment in their respective schools. Data were analyzed using mean, standard deviation and ANCOVA. Results revealed that the ethno-science based instructional package was superior

to conventional package in fostering interest in science; the ethno- science based package yielded a higher interest in science among females than males; there was significance difference in the mean interest scores of students taught science using ethno-science based instructional package than those taught with conventional package. This study is related to the present study in that both determined students interest and in the method of data analysis but differs in that the present study used WCPT and RPT peer tutoring strategies in biology while the study by Abonyi was done in integrated science.

Studies on Students' Achievement in Biology

Opara (2008) carried out a study on inquiry method and students' academic achievement in Biology. Three research questions with null-hypothesis guided the study with the aid of quasi-experimental design. The students were randomly assigned to two groups (treatment and control group). Treatment group were taught Biology using sensitized inquiry teaching method while conventional method (lecture) was used to teach the control group. Data was collected using Biology Achievement Test (BAT). The treatment lasted for four weeks; the achievement test was administered to both groups, and was analyzed using ANCOVA. The result of the studies shows that inquiry teaching method had significant effect on students' achievement in Biology. Inquiry teaching method had generally, greater positive effect on students' interest, attitudes and achievement in science. The study conducted by Opara is related to the present study in design, and ANCOVA was used in analyzing both data, but they differs in several ways, the study conducted by Opara was guided by three null hypotheses, the present study was guided by six null hypotheses. Opara's study was aimed at investigating the effects of inquiry strategy on students' achievement and interest, the present study was on effects of peer tutoring on achievement and interest of students.

Nwagbo and Okoro (2012) studied the effects of interaction patterns on achievement of students in Biology. The study used a quasi-experimental control group design. The study was conducted in Obollo Afor Education Zone of Enugu State. The study used a purposive random sampling to select four single sex schools out of seven schools. Two of the schools were for females while the other two were for male. The sample consisted of three hundred and sixty (360) SS 11 Biology students. The instrument for data collection was Biology Achievement Test (BAT). Three intact classes which were assigned to cooperative, competitive, and individualist groups were used for the study. Mean and standard deviation were used to answer the research questions while ANCOVA was used to test the null hypotheses at 0.05 level of significance. The study revealed that the three interaction patterns cooperative, competitive and individualistic enhanced achievement of students in Biology. It also showed that average scores for boys were constitutently higher than that of girls in the three groups. The study above is related with the present study in terms of subject, instrument for data collection and instruments for data analysis. But differs in the area of study and topic.

Enebechi (2016) carried out a study on the effect of two instructional scaffolding strategies on secondary school students' achievement and interest in Biology in Udi Education Zone of Enugu State. The study adopted a factorial research design. The population of the study was two thousand six hundred and twenty four (2,624) students. A purposive sampling technique was used to sample 140 students from the zone. The experimental group was exposed to queuing question while the control groups were exposed to concept mapping. Biology Interest inventory (BII) and Biology Achievement Test (BAT) were used for data collection. Kuder-Richardson (K-R 20) and Cronbach Alpha statistics was used to determine the reliability of the instruments. The data was analyzed using ANCOVA. The result showed that among others that queuing questions

strategy has more effect on students mean achievement scores in biology than the concept mapping strategy; cueing questions strategy has more effect on students mean interest scores in biology than concept mapping strategy. The study by Enebechi is related to the present study in the areas of subject, instrument for data collection and analysis but differs in the area of the study and topic.

Studies on Influence of Gender in Science

Nwagbo (2011) carried out a study on the effects of Biology practical activities on secondary school students' process skill acquisition in Abuja municipal Area Council and the influence of gender in the acquisition of science process skills. The design of the study was quasi experimental, specifically the pretest, posttest non- equivalent control group design. A sample of one hundred and eleven (111) senior secondary one (SS1) Biology students was randomly drawn from 2 co-educational schools was used for the study. An instrument known as Science Process Skill Acquisition (SPSAT) was used for data collection. The data collected was analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA) at 0.05 level of significance. The result revealed that practical activity method was more effective in fostering student's acquisition of science process skills than the lecture method. There was no interaction between method and gender on student's process skill acquisition. The study by Nwagbo is related with the present study in the areas of design and method of data analysis, but differs with the present study in the area of study and subject used in the research.

Ibe (2006) investigated the effect of gender and teaching method on science process skill acquisition among the senior secondary students in Nsukka Local Government Area of Enugu State. The study was a quasi-experimental design involving non-equivalent control pre-test post-test. A sample of 150 senior secondary one (SS1) from co-educational schools randomly sampled

from 17 co-educational schools in Nsukka Local Government were involved in the study. Intact classes were assigned to two treatment groups and a control group. Students in the experimental groups A and B were taught using inquiry and demonstration methods respectively while those in the control group did not receive any treatment. Two research questions and 2 hypotheses guided the study. The instrument for data collection was a self-made test adopted from Nwosu (1991) called Test of Science Process Acquisition (TOSPSA). Data was analyzed using means, standard deviation and ANCOVA. The result showed that boys generally slightly outperformed the girls but that teaching method had stronger effect than gender on levels of acquisition of science process skill in the study. The high level of acquisition of science process skill by both males and females in the guided inquiry method reveal that girls can do equally in science as boys when they are effectively and adequately exposed to science courses. The findings of this study indicates that with effective teaching method that can appeal to and motivate the students , gender equality in science achievement could be achieved. The above study is related to the present study in method of data analysis, but differs as the present study investigated on students' interest and achievement in Biology using peer tutoring.

Nworgu (2004) investigated on the effects of gender sensitization of science teachers on gender gap in science achievement and interest among students. The study was carried out with JSS 11 students in public secondary schools in Nsukka Local Government Area of Enugu State. Four research questions and six null hypotheses tested at 0.05 level of significance guided the study. The design of the study was quasi-experimental specifically non-equivalent control group design. The sample of the study was 245 JSS 11 students drawn from six secondary schools by purposive sampling technique. Three streams of JSS 11 in the three of the sampled schools were experimental while the other three streams were the control group. The instruments for data

collection were the Integrated Science Interest Scale (ISIS). And Integrated Science Achievement Test (ISAT). The content of GSIP was drawn from Integrated Science national curriculum. Pre-test and post-test were administered on the participants before and after the experiment respectively. Mean and standard deviation were used to answer research questions while ANCOVA was used to test the null hypotheses. The result of the study revealed that: Gender sensitization Instructional Approach (GSIP) enhanced students achievement in integrated science more than the conventional instructional approach; GSIP facilitated students' interest in integrated science more than the conventional instructional approach; There was significant difference in mean achievement scores of male and female students in favor of males.; GSIP reduces the gender gap in achievement drastically or substantially, CIA tended to widen gender gap in achievement; Female students developed significant higher interest than male students when exposed to gender sensitization package: There was no significant sensitization by gender interaction effect on integrated science students interest scores. Nworgu's study was much relevance to the present study especially for the fact that the study included gender which the present study investigated. Other areas of relevance include; use of coeducational schools, design of the study and method of data analysis. However, the present study differs with that of Nworgu in that the present study was carried in biology using WCPT and RPT which was in total disparity with Nworgu.

Summary of Literature Review

The literature reviewed showed that peer tutoring may be an active factor in academic achievement. It is widely used in all levels of education. It was also observed that peer tutoring has been defined by many researchers thereby making the meaning become clear, it is not necessarily only about transmission of knowledge from more experienced student to less

experienced students rather, there is a mutual transfer of knowledge from one student to another in a social sense. The literature also reviewed the several modes of peer-tutoring such as Whole Class Peer Tutoring, Same Age Peer Tutoring, Reciprocal Peer Tutoring and Peer Assisted Learning Strategies. Therefore, this present study wishes to explore the effects of Whole Class Peer Tutoring and Reciprocal Peer Tutoring strategies on students' academic achievement and interest in biology in Onitsha Education Zone.

Studies on interest indicate that, a child develops interest if a particular stimulus is attractive and arousing or stimulating. Thus, students are bound to pay attention as a lesson goes on if the student is interested in that particular lesson. It also reviewed that three categories of interest exist such as individual, situational and interest-induced psychologically. Interest is a very strong indispensable tool in teaching and learning programs. It determines the extent and direction of attitudes towards sciences and largely determined the kind of interest developed by students to affect academic achievement in their various course of study. In conjunction with the above, interest becomes a driving force to achieve the desired goals, so without interest, learning objectives will not be achieved.

Furthermore, the literature review on theoretical framework on Vygotsky's social constructivism theory states that knowledge is not simply constructed; it is co-constructed. Therefore, peer-tutoring teaching strategy is a social constructivism learning based on Vygotsky's concept of the Zone of Proximal Development (ZPD), which shows the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers or teachers. In the same vein, Bruner's theory of learning was also reviewed in connection to the present study. It was observed that test management

requires, co-operating and interacting with others when acquiring knowledge, will enhance, and facilitate academic achievement, and arouse interest of students. Therefore, there is need for this study to find out whether WCPT and RPT modes of peer tutoring can arouse interest and improve academic achievement of students in biology.

Thus, from the empirical studies, it was observed that no apparent differences exist between academic achievements and interest of boys and girls, but there appeared a difference among students' academic achievements of students. Therefore, gender alone as a factor cannot affect interest and academic achievement in science but when combined with other factors will affect academic achievement and interest.

A lot of research relevant to gender issues with respect to achievement of students has been done. A lot of researchers from reviewed literature is of the opinion that there is no significant difference as a result of gender when students are exposed to the same approach of instruction. While some researchers point out that there is a significant difference in favor of male and vice versa. So there is no consensus as to whether gender influences achievement or not. This study further investigated the influence of gender on achievement and interest of students taught WCPT and RPT modes of peer tutoring in biology using peer tutoring.

Finally, results of empirical studies carried out in other geographical areas and other subject areas have shown that training in the use of reciprocal peer tutoring and class wide peer tutoring strategies can have positive effect in enhancing students' achievement and interest. A major problem as is evident from literature is that there is a general dearth of empirical works in biology using the two strategies. Hence, this study finds out the effectiveness of whole class

peer tutoring and reciprocal peer tutoring in improving students' achievement and interest in biology in Onitsha education zone of Anambra state.

CHAPTER THREE

RESEARCH METHOD

This chapter presents the research method under the following subheadings: design of the study, area of the study, population of the study, sample and sampling techniques, instrument for data collection and method of data analysis.

Design of the Study

The design adopted for this study is quasi experimental design, specifically the non-equivalent control group design. The design was used because in quasi experimental research, random assignment of subjects to experimental and control group is not possible (Nworgu 2015). Because of this constraint, intact or pre-existing groups were used for both control and experimental groups.

The diagrammatic sketch of the design of the study is as follows;

$Y_b \times Y_a$

 $Y_b - \times Y_a$

Where:

Y_b = pre-test (measurement taken before treatment).

Y_a = post-test (measurement taken after treatment).

$\times$ = treatment given to experimental group using class wide peer tutoring.

$-\times$ = teaching of the control group using reciprocal peer tutoring.

Area of the Study

This study was carried out in Onitsha Education zone of Anambra State. Onitsha zone is one of the six education zones in Anambra State. It comprises Onitsha North Local Government Area with a total of 16 secondary Schools, Onitsha South Local Government Area with a total of 6 secondary schools and Ogbaru Local Government Area with a total of 10 secondary schools. Onitsha education zone was chosen, because the researcher has taught in the zone and noted low academic achievement of students in Biology.

Population of the Study

The population of this study comprises 6, 270 SSII Biology students in all the secondary schools in Onitsha Education Zone (Post Primary Schools Commission, Onitsha, PPSCO. 2018). This consists of 3, 518 female and 2,752 male students. This population comprised the whole Biology students in the thirty two secondary (32) schools in the zone. Out of the thirty two schools, twenty (21) are co-educational and 11 are single sex schools (see appendix G, p. 97). The choice of year two senior secondary school students is because the topics to be used for the study fall within the scheme of work of the targeted class. Also, they are more stable for the study unlike the SS3 classes that may not be available during the study because of external examination.

Sample and Sampling Technique

The sample of the study consists of 180 SSII biology students which comprised of 88 males and 92 females who were selected using stratified random sampling technique and simple random sampling technique. Stratified random sampling technique was used to draw two co-educational schools from each of the three local government Areas namely: Onitsha North,

Onitsha South and Ogbaru, making it a total of 6 secondary schools. Co-educational schools were used to take care of gender variable in the study. The researcher randomly assigned 3 schools to the experimental group and the remaining 3 secondary schools to the control group. In each sampled school, the researcher used all the students in an intact science class as shown in appendix H (p.98) making the total sample size to be 180.

Instrument for Data Collection

Two main instruments used for data collection in this study are:

- 1) Biology Achievement Test (BAT)
- 2) Biology Interest Scale (BIS)

The two instruments were constructed by the researcher

Biology Achievement Test (BAT)

The BAT is a 30 multiple-choice objective test. Each item has four options lettered A-D. The test is based on the four biology topics used for the study such as pollution and its control, conservation of natural resources adaptation and association (See Appendix Ca, p. 86.). The justification for the use of the above topics is because students' exposure to them would help to ensure environmental sustainability which is among the goals of sustainable development. The items measured the six objectives in the cognitive domain of Blooms taxonomy of educational objectives. Appendix B p. 85 shows the table of specification used in constructing the BAT objective items. The items were scored by assigning one (1) mark to each correct item and zero (0) for incorrect item. The total scores obtained by each student were then converted to percentage. Therefore, the maximum obtainable score per student was one hundred (100).

Biology Interest Scale (BIS).

The BIS is a 16 item scale developed by the researcher. Using the four –point scale provided, the respondents responded to the items by ticking (✓) to their degree of agreement or disagreement to the items. The respondents were required to indicate their responses with a tick(✓) with reference to four point scale of strongly Agree (SA) 4 points; Agree (A) 3 points; Disagree (D) 2 points; Strongly Disagree (SD) 1 point. The BIS is shown in (Appendix D p. 92). They are made up of positive and negative items.

Validation of the Instruments

The draft of BAT was given to three experts; two in measurement and evaluation and one in Biology option all in the department of science education for face validation. Three copies of the draft (30 items each) with the table of specification and lesson plan were sent to the experts. In order to assess the instrument in terms of clarity of expression, suitability of items accuracy of answers and content coverage. They also made suggestions and amendments in the instrument where necessary.

For content validity, the validated table of specification used in constructing BAT and suggestions from validators ensured content validity of the instrument. The table of specification ensured adequate sampling of the content taught. Appropriate number of questions was drawn to reflect the various levels of Blooms Taxonomy of Educational Objectives of cognitive domain. Thereafter, the 30 items that were face validated, were trial tested on 30 male and female students.

The draft of BIS (20 items) was given to the same three experts that validated the BAT. The validators also assessed the instruments in terms of clarity of expressions and suitability of the items. The 20 items with four – point scale were face validated. After the face validation, four items were removed because the report of validators indicated that they were not suitable. The

remaining 16 items were trial tested in the same school and students where BAT was also trial tested.

Reliability of the Instrument

For BAT, the reliability coefficient was determined with Kuder- Richardson formula (K-R20) method. The use of K-R20 formula helped to estimate the internal consistency of BAT items. The researcher administered the 30 items to 30 students. The scores obtained were used to compute the coefficient of internal consistency of BAT, which was found to be 0.83 (see Appendix E, p. 94). The BAT items being dichotomously scored meant that the K-R20 method was appropriate.

The reliability coefficient of BIS was determined with Cronbach alpha method which helped to estimate the internal consistency. The same school used for BAT trial-testing was also used for BIS. The BIS items being polytomously scored meant that Cronbach alpha method was appropriate. The reliability coefficient of BIS computed with computer software on SPSS was 0.82 (see Appendix F, p.96).

Experimental Procedure

The study lasted for seven (7) weeks. The first four days were used for training of teachers Six biology teachers in the sampled schools used for the study were trained. The three biology teachers in the experimental schools were trained on the use of WCPT whereas the three biology teachers in the control schools were trained on the use of RPT. The researcher visited the schools for two weeks. In other to monitor their progress, one week for the three experimental schools and the remaining one week for the three control schools. Teachers in the experimental schools were trained on how to group the students based on their ability levels, how to organize the sub topics and how to assign them to the tutor's using the lesson plan (see

Appendix J, p. 100). After the training, the Biology Achievement Test (BAT) and Biology Interest Scale (BIS) were administered to the students of both schools as pre-test. The pre-test was marked and scored in order to get the achievement of students. From the students' scores the researcher, with the help of the teachers selected those students that have high scores that were used as peer tutors in the experimental schools. Thereafter, the main teaching commenced. Teaching in the experimental group was done using (WCPT) and students were first of all grouped into average of 5 students in a group with a group leader in each group who served as peer tutor. Teachers had a pre-discussion class with the peer tutors a day before the main teaching, where sub units of the new concepts were assigned to these peer tutors to read up. In each lesson, after introducing the topic, the teacher called upon the first peer tutor to take up the first sub unit of the concept and explain to the tutees. The teacher did same to the other tutors while teachers moderate the entire activities of the lesson appropriately. This continued until the concept was exhausted. In the control schools, teaching was done using RPT where students alternate between the roles of tutor and tutees. The class was grouped into 5 groups and students discussed by themselves and select their group representative, then at each stage, the teacher calls on them one after the other to teach until the topic was exhausted (see Appendix K, p. 131). At the end of the experiment, a post-test for BAT and BIS were administered to the students. Data for pre-test and post-test were recorded separately for each of the students in the experimental schools and control schools and were used for analysis according to the demands of the research questions and hypotheses.

Training Procedure for the Research Assistants

The training lasted for 4 days. On the first day, the researcher introduced herself and went ahead to discuss the segments involved in the study such as pretest, main teaching and posttest to

both the experimental and control group teachers. At the end of that day, teachers in the experimental group were asked to meet with the researcher the second day while teachers in the control group were requested to come on the third day. On the second day, the researcher taught the teachers on the experimental group how to carry out peer tutoring using WCPT, which involves grouping of students based on their ability levels, organizing of the sub topics and assigning of the sub topics to the peer tutors. At the end of the day, the researcher gave out the materials to be used for the study to the teachers. On the third day, the researcher met with teachers in the control schools and discussed with them how to carry out peer tutoring using RPT which involves students taking turns either as tutor or tutees. Finally on the fourth day, teachers in the experimental groups presented a micro teaching based on what they were taught.

Control of Extraneous Variables

To ensure that the extraneous variable which could introduce bias or error in the study was checked, the following measures were employed by the researcher.

Hawthorne Effects

Hawthorn effect means people faking their behaviors (Nworgu, 2015). In order to avoid this, the researcher did not teach by herself. Nevertheless, to ensure uniformity of instruction, the researcher developed the lesson notes that were used in the normal biology classroom teaching. The researcher also coordinated the regular biology teachers on the conduct of the study in order to ensure uniformity of instruments.

Teacher Effect/Variable

To control the variables, the researcher trained the biology teachers and coordinated the activities during training workshop of teachers, to ensure acceptable and uniform standard. In

addition, the researcher prepared lesson plans used to implement the teaching of the groups. The teachers were trained on how to use lesson plans, grouping of students based on their ability level. This measure helped to control variability in instructional procedure in the study.

Subject Interaction

Treatment and control groups were not selected from the same school. This was to ensure that no interaction existed between the treatment and control groups.

Method of Data Analysis

Mean and Standard Deviation was used to answer the six research questions while Analysis of Covariance (ANCOVA) was also used to test the six null hypotheses at 0.05 level of significance. This was used because of the pre test scores which was used as covariate.

CHAPTER FOUR

RESULTS

This chapter is concerned with the presentation of results from data analysis. The results are presented in tables according to the research questions and hypotheses that guided the study.

Research Question 1:

What are the mean achievement scores of students in biology when exposed to RPT strategy and those exposed to WCPT strategy?

Table 1: Descriptive Statistics Using Mean and Standard Deviation of Pre and Post Achievement Scores of Students' Taught Biology using RPT and WCPT Strategies

Strategies	N	Pretest		Posttest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
RPT Strategy	90	32.57	9.28	51.24	5.50	18.67
WCPT Strategy	90	33.17	7.80	55.66	5.39	22.49

NB: WCPT = whole class peer tutoring strategy; RPT = reciprocal peer tutoring.

Results in Table 1 show that the group taught biology using RPT strategy had a pre achievement mean score of 32.57 with a standard deviation of 9.28 and a post achievement mean score of 51.24 with a standard deviation of 5.50. The group taught biology using WCPT strategy had a pre achievement mean score of 33.17 with a standard deviation of 7.80 and a post achievement mean score of 55.66 with a standard deviation of 5.39. The group taught with WCPT strategy made a mean gain of 22.49 more than the group taught with RPT strategies that has a mean gain of 18.69. To ascertain whether the result is real or as a result of errors in the cause of research, then the result was subjected to inferential testing as shown below.

Hypothesis 1

H₀₁: There is no significant difference in the mean achievement scores of students in biology when exposed to RPT and those exposed to WCPT strategies.

Table 2: Analysis of Covariance (ANCOVA) of the significant difference in the mean achievement of biology students' taught using RPT and those taught with WCPT Strategies.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1084.969 ^a	4	271.242	9.371	.000
Intercept	33722.582	1	33722.582	1165.010	.000
Pretest	15.602	1	15.602	.539	.464
Gender	159.495	1	159.495	5.510	.020
Strategies	922.083	1	922.083	31.855	.000
Gender * Strategies	34.196	1	34.196	1.181	.279
Error	5065.581	175	28.946		
Total	520393.000	180			
Corrected Total	6150.550	179			

The result in Table 2 shows that an F-ratio of 31.86 was obtained with associated probability value of 0.00 for the two groups. Since the associated probability value of 0.00 was less than 0.05 set as bench mark, the null hypothesis (H_{01}) which stated that there is no significant difference in the mean achievement scores of students in biology when exposed to RPT and those exposed to WCPT strategies is rejected.

Research Question 2

What are the mean interest scores of students in biology when exposed to RPT strategy and those exposed to WCPT strategy?

Table 3: Descriptive Statistics Using Mean and Standard Deviation of Pre and Post Interest Scores of Students Taught Biology using RPT and WCPT Strategies

Strategies	N	Pretest		Posttest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
RPT Strategy	90	2.69	0.39	2.97	0.39	0.28
WCPT Strategy	90	2.66	0.36	3.51	0.33	0.85

Results in Table 3 show that the group taught biology using RPT strategy had a pre interest mean score of 2.69 with a standard deviation of 0.39 and a post interest mean score of 2.97 with a standard deviation of 0.39. The group taught biology using WCPT strategy had a pre

interest mean score of 2.66 with a standard deviation of 0.36 and post interests mean score of 3.51 with a standard deviation of 0.33.

Hypotheses 2

HO₂: There is no significant difference in the mean interest scores of students' in biology when exposed to RPT and those exposed to WCPT strategies.

Table 4: Analysis of Covariance (ANCOVA) of the significant difference in the mean interest of Biology students' taught using RPT and those taught with WCPT strategies.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	14.140 ^a	4	3.535	27.323	.000
Intercept	32.798	1	32.798	253.496	.000
Pretest	.035	1	.035	.274	.601
Gender	.368	1	.368	2.846	.093
Strategies	13.395	1	13.395	103.527	.000
Gender * Strategies	.726	1	.726	5.610	.019
Error	22.642	175	.129		
Total	1927.484	180			
Corrected Total	36.782	179			

The result in Table 4 shows that, an F-ratio of 103.53 was obtained with associated probability value of 0.00 for the two groups. Since the associated probability value of 0.00 was less than 0.05 set as bench mark, the null hypothesis (H₀₂) which stated that there is no significant difference in the mean interest scores of students in biology when exposed to RPT and those exposed to WCPT strategies is rejected.

Research Question 3

What are the mean achievement scores of male and female students in biology?

Table 5: Descriptive Statistics Using Mean and Standard Deviation of Pretest and Post test of Male and Female Students' Achievement in Biology

Gender	N	Pretest		Posttest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Male	88	32.64	9.14	54.32	5.28	21.68
Female	92	33.09	8.00	52.62	6.29	19.62

Results in Table 5 show that the male group taught Biology had a pre achievement mean score of 32.64 with a standard deviation of 9.14 and a post achievement mean score of 54.32 with a standard deviation of 5.28. The female group had a pre achievement mean score of 33.09 with a standard deviation of 8.00 and a post achievement mean score of 52.62 with a standard deviation of 6.29. Male students have mean gain of 21.63 higher than female students who have mean gain of 19.62. To ascertain whether the result is real or as a result of errors in the cause of research, then the result was subjected to inferential testing as shown below

Hypothesis 3

There is no significant difference in the mean achievement scores of male and female students in Biology.

The result in **Table 2**, an F-ratio of 5.51 was obtained with associated probability value of 0.02 the male and female students. Since the associated probability value 0.02 was less than 0.05 set as bench mark, the null hypothesis (H_{03}) which stated that there is no significant difference in the mean achievement scores of male and female students in Biology is rejected.

Research Question 4

What are the influences of gender on students' interest in Biology?

Table 6: Descriptive Statistics Using Mean and Standard Deviation of Pretest and Posttest of Male and Female Students Interest in Biology

Gender	N	Pretest		Posttest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Male	88	2.63	0.38	3.27	0.52	0.64
Female	92	2.72	0.36	3.21	0.38	0.49

Results in Table 6 shows that the male students taught Biology had a pre interest mean score of 2.63 with a standard deviation of 0.38 and a post interest mean score of 3.27 with a standard deviation of 0.52. The female students had a pre interest mean score of 2.72 with a standard deviation of 0.36 and a post interest mean score of 3.21 with a standard deviation of 0.38.

Hypothesis 4

There is no significant difference in the mean interest scores of male and female students in Biology.

The result in **Table 4** shows that, an F-ratio of 2.85 was obtained with associated probability value of 0.09 with respect to the interest scores of male and female students. Since the associated probability value of 0.09 was higher than 0.05 set as bench mark, the null hypothesis (H_{04}) which stated that there is no significant difference in the mean interest scores of male and female students' in Biology was not rejected.

Research Question 5

What are the interaction effect of instructional strategies and gender on students' achievement?

Table 7: Mean and Standard Deviation of Respondents on the Interaction Effect of Instructional Strategies and Gender on Students' Achievement

Strategies	Gender	N	Pretest		Posttest		Mean Gain
			$\bar{x}$	SD	$\bar{x}$	SD	
RPT	Male	46	31.93	10.24	51.76	3.83	19.83
	Female	44	33.23	8.23	50.70	6.83	17.47
WCPT	Male	42	33.40	7.80	57.12	5.26	23.72
	Female	48	32.96	7.87	54.38	5.22	21.42

Results in Table 7 shows the interaction effect of instructional strategies and gender on students' achievement in Biology. Results shows that the male students taught Biology using RPT had a pre achievement mean score of 31.93 with a standard deviation of 10.24 and a post mean score of 51.76 with a standard deviation of 3.83; the female students taught Biology using RPT had a pre achievement mean score of 33.23 with a standard deviation of 8.23 and a post achievement mean score of 50.70 with a standard deviation of 6.83. While the male students taught Biology using WCPT had a pre achievement mean score of 33.40 with a standard deviation of 7.80 and a post achievement mean score of 57.12 with a standard deviation of 5.26. The female students taught Biology using WCPT had a pre achievement mean score of 32.96 with a standard deviation of 7.87 and a post achievement mean score of 54.38 with a standard deviation of 5.22. The difference between the pretest and posttest achievement mean score for the female student taught Biology using WCPT was 21.42.

Hypothesis5

There is no significant interaction effect of instructional strategies and gender on students' achievement in Biology.

The result in Table 2 shows that with respect to the interaction effect of instructional strategies and gender on students' achievement in Biology, an F-ratio of 1.18 was obtained with associated probability value of 0.28. Since the associated probability value of 0.28 was greater than 0.05 set as bench mark, the null hypothesis (H_{05}) which stated that there is no significant interaction effect of instructional strategies and gender on students' achievement in Biology is not rejected.

Figure 2 revealed that strategies and gender do not interact to affect students' achievement in Biology. This is noticed when the strategies (RPT and WCPT) lines drawn against gender (male and female) do no intercept at any point. The graph is shown below.

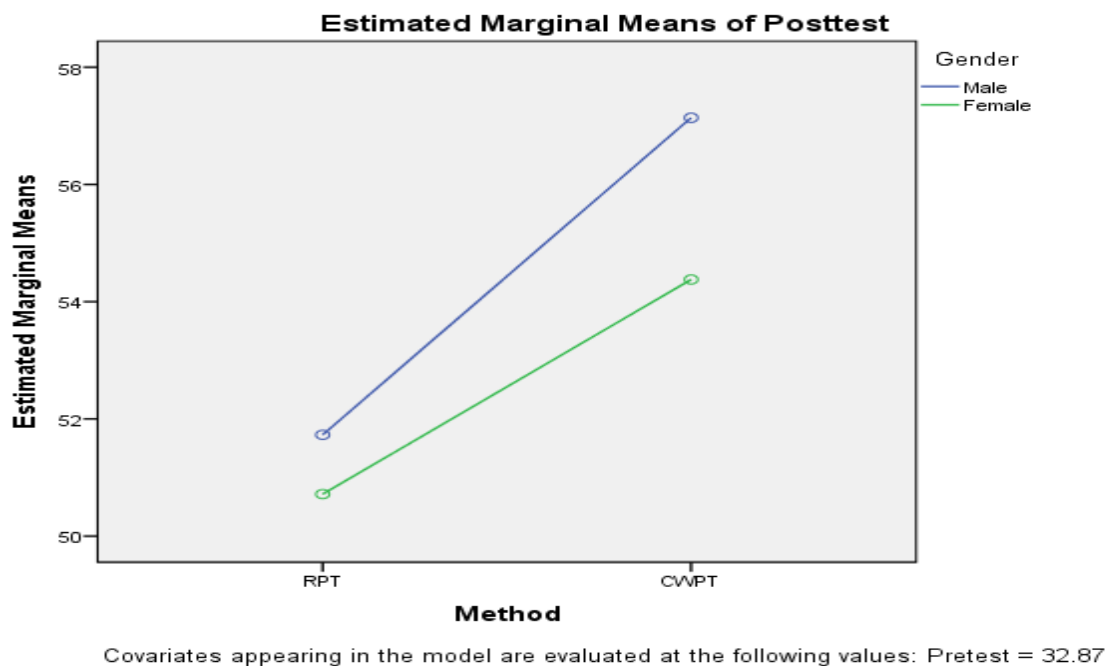


Fig. 2: Graph showing the interaction effect of instructional strategies and gender on students' achievement in biology.

Research Question 6

What are the interaction effect of instructional strategies and gender on students' interest in Biology?

Table 8: Descriptive Statistics Using Mean and Standard Deviation of Respondents on the Interaction Effect of Instructional Strategies and Gender on Students' Interest in Biology

Strategies	Gender	N	Pretest		Posttest		Mean Gain
			$\bar{x}$	SD	$\bar{x}$	SD	
RPT	Male	46	2.72	0.44	2.95	0.41	0.23
	Female	44	2.67	0.33	2.99	0.38	0.32
WCPT	Male	42	2.54	0.29	3.62	0.39	1.08
	Female	48	2.76	0.39	3.41	0.24	0.65

Results in Table 8, shows the interaction effect of instructional strategies and gender on students' interest in Biology. Results shows that the male students taught Biology using RPT had a pre interest mean score of 2.72 with a standard deviation of 0.44 and a post interest mean score of 2.95 with a standard deviation of 0.41; the female students taught Biology using RPT had a pre interest mean score of 2.67 with a standard deviation of 0.33 and a post interest mean score of 2.99 with a standard deviation of 0.38. While, the male students taught Biology using WCPT had a pre interest mean score of 2.54 with a standard deviation of 0.29 and a post interest mean score of 3.62 with a standard deviation of 0.39. The difference between the pre and post interest mean score for the male students' taught Biology using WCPT was 1.08. The female students taught Biology using WCPT had a pretest interest mean score of 2.76 with a standard deviation of 0.39 and a posttest interest mean score of 3.41 with a standard deviation of 0.24. The difference between the pre and post interest mean score for the female student taught Biology using WCPT was 0.65.

Hypothesis 6

There is no significant interaction effect of instructional strategies and gender on students' interest in Biology.

The result in Table 4 shows that with respect to the interaction effect of strategies and gender on students' interest in Biology, an F-ratio of 5.61 was obtained with associated probability value of 0.02. Since the associated probability value of 0.02 was less than 0.05 set as bench mark, the null hypothesis (H_{06}) which stated that there is no significant interaction effect of instructional strategies and gender on students' interest in Biology is rejected.

Figure 3 revealed that instructional strategies and gender interact significantly to affect students' interest in Biology. This is noticed when the instructional strategies (RPT and WCPT objects) intercept at a point. The graph is shown below.

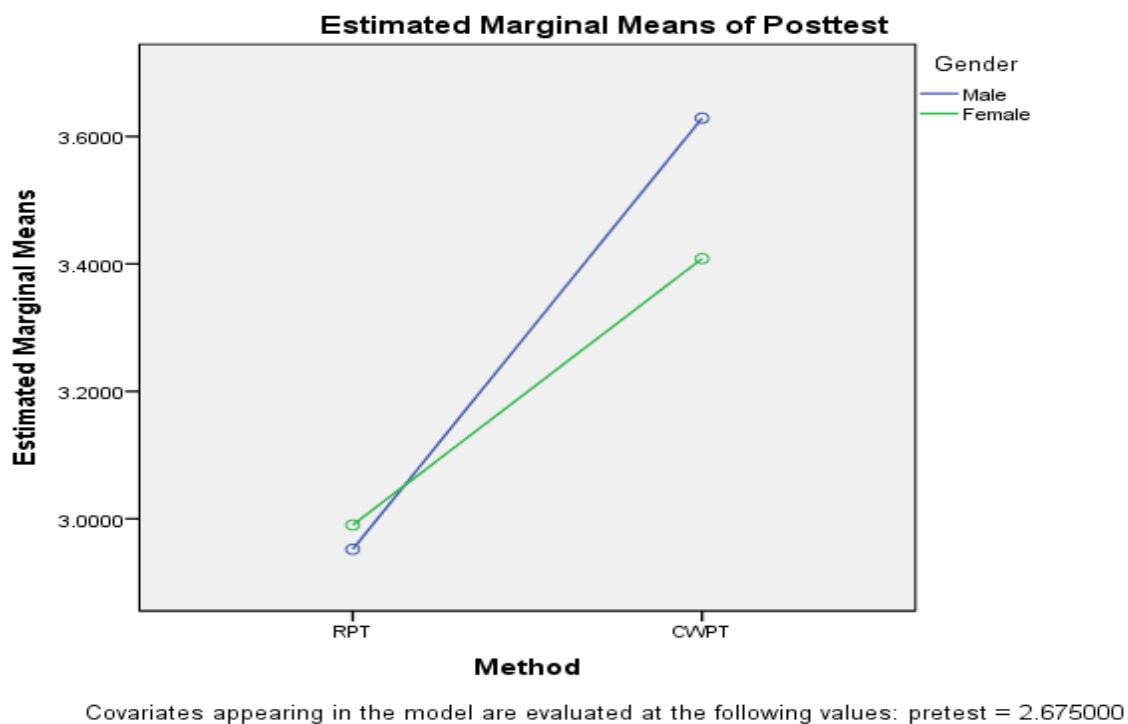


Fig. 3: Graph showing the interaction effect of instructional strategies and gender on students' interest in Biology

Summary of the Findings

From the data analysis and interpretation of the results, the following findings emerged;

1. There was a significant difference in the mean achievement score of students taught biology using RPT and WCPT strategies, with those taught using WCPT strategy having higher mean gain score.
2. There was a significant difference in the mean interest score of students taught biology using RPT and WCPT strategies with those taught with WCPT strategy having higher mean interest score.
3. There was a significant difference in the mean achievement scores of male and female students in biology with the male group having higher mean gain.
4. There was no significant difference in the mean interest scores interest scores of male and female students in Biology.
5. There was no significant interaction effect of strategies and gender on students' achievement in biology.
6. There was a significant interaction effect of instructional strategies and gender on students' interest in biology.

CHAPTER FIVE

DISCUSSION, CONCLUSION, RECOMMENDATIONS AND SUMMARY

In this chapter, the results presented in chapter four are discussed based on the six research questions and six null hypotheses that guided the study. The chapter is organized based on the following sub-headings: Discussion of Findings, Conclusion, Educational Implications, Recommendations, Limitation of the Study, Suggestion for Further Studies and Summary of the Study.

Discussions of Findings

The discussion of research findings is carried out in the light of literature reviewed.

The effect of RPT strategy and WCPT strategy on students' achievement in Biology

The result of the study in Table 1 shows that WCPT strategy improved students' achievement in Biology more than RPT strategy. In other words, teaching biology with WCPT strategy proved to be more effective. Further, the finding of the study showed that there was a significant difference ($p < 0.05$) in the mean achievement score of students taught biology when exposed to RPT and WCPT strategies with those taught using WCPT strategy having higher mean gain score. The finding of this study is in line with Greenwood, Terry and Arreaga-Mayer (1992), who discovered that students taught with WCPT made educationally important gains. The success of the students' exposed to WCPT in improving students achievement over students exposed to RPT may have been as a result of class wide peer tutoring, which involves highly structured procedures, direct rehearsals and competitive teams. These could explain the result of this study. Class wide peer tutoring strategy uses skills such as predicting, clarifying, questioning and summarizing, which potentially help students to understand what they read. The studies by Peter (2006), Cahoon and Fuchs (2003) also indicated an improvement on students achievement

when taught using peer tutoring generally. This students' improved achievement could be as a result of peer tutoring was used over conventional method as control.

The effect of RPT strategy and WCPT strategy on students' interest in Biology

Finding from this study in Table 3, indicate that WCPT strategy improved students' interest in Biology than RPT strategy. In other words, teaching biology using WCPT strategy proved to enhance students' interest. Further, the findings of the study in Table 4 showed that there was a significant difference ($p < 0.05$) in the mean interest score of students taught biology using RPT and WCPT strategies, with those taught using WCPT strategy showing more interest. This study is in line with Ezenwosu (2008) who discovered that peer tutoring generally increases students' interest in biology. Though, the study by Ezenwosu did not specify the type of peer tutoring used. However, the present study is not in line with Uroko (2010) who discovered that students taught with RPT had higher interest than those taught with conventional method. The source of the difference could be as a result of the teaching method that was used as control in both studies.

The influence of gender on students' achievement in biology

Finding from the study in table 3 revealed that male students performed better than the female students. Also, the finding of the study in table 2 showed that there was a significant difference in the mean achievement scores of male and female students in biology with the male students having higher mean gain score. In other words, it implies that male achieved better than their female counterpart. This study is in line with Nwagbo and Okoro (2012) who discovered that the average scores of boys were consistently higher than that of girls on achievement of students in biology. The study also corresponds with Nworgu (2004) who found out that there was significant difference in the mean achievement scores of male and female students in favor

of male students. The significance difference in achievement of male students compared with the female students may be attributed to the belief some female students have that science is meant for the boys.

The influence of gender on students' interest in biology

The result of the study revealed that the male students had higher interest score than the female students; this difference was however not significant. This is in line with Ibe (2006) who found out that male students slightly have higher interest than female students. This study also is in line with Ezenwosu (2003) who found out that there was no significant effect of method and gender on students mean interest scores in biology. This shows that WCPT is not based on gender.

The interaction effect of strategies and gender on students' achievement in Biology

The findings of the study reveals that in all cases, the post achievement means scores were greater than the pre achievement means scores with the male students having a higher achievement mean gain score in both WCPT and RPT; and there was no significant interaction effect of strategies and gender on students achievement in biology. The result of this study is consistent with Nwagbo and Okoro (2012) who found out that three interaction patterns cooperative, competitive and individualistic enhanced achievement of students in biology. This study also corresponds with the findings of Ezenwosu (2013) who found out that there was no significant interaction effect between peer tutoring and gender on students' achievement. Though the present study compared two modes of peer tutoring while the study by Ezenwosu used peer tutoring generally. The study by Nwagbo and Okoro, Ezenwosu are related to this study in that both studies showed no significant interaction among the variables under study.

The interaction effect of strategies and gender on students' interest in Biology

The findings of the study shows that in all cases, the post interest means scores were greater than the pre interest means scores with the male students having a higher interest mean gain in both RPT and WCPT; and there was a significant interaction effect of instructional strategies and gender on students' interest in Biology. This could be as a result of the notion that science subjects are meant for male students than the female students. This notion is quite unacceptable as teaching and learning should boost the interest of students irrespective of gender. The result of the studies is constituent with that of Okoro (2008) who found out that the three interaction patterns; co-operative, competitive and individualistic patterns enhanced student's achievement and interest in biology. The finding of Okoro is related to the findings of the present study in terms of interaction and gender. Okoro's study revealed that an interaction pattern existed on the variables of concern to the study while, the present study found a significant interaction effect of instructional strategies and gender on students interest in biology. This study disagrees with Nworgu (2004) who found out that there was no significant sensitization by gender interaction effect on integrated science students' interest scores. This disagreement could be as a result of strategies used.

Conclusion

Based on the findings of the study, it is concluded that;

Although peer tutoring instructional strategy improved students learning in biology, the whole class peers tutoring (WCPT) proved to be significant in improving students' achievement and interest in biology more than reciprocal peer tutoring (RPT). Peer tutoring improves students interest in biology, irrespective of gender. But appears to favour the male students more

in achievement than the female students. This could be as a result of different modes of peer tutoring used.

Educational Implications of the Findings

The findings of this study have some educational implications for biology teachers, students, curriculum planners and researchers.

The results of this study have provided empirical evidence in respect of the effectiveness of class wide peer tutoring strategy in improving students' achievement and interest in biology. The findings suggests the need for students to be equipped with relevant skills in the use of class wide peer tutoring strategy in order to facilitate their learning areas in biology and other related subjects. This demands that teachers in preparing to teach would find this strategy effective as it involves the learners in teaching one another thereby making the teacher sees his or herself as a facilitator of learning.

Since WCPT was found to be effective in this study, teachers can adopt this strategy in solving the problem of poor achievement and in interest in biology and their related subjects. The curriculum planners are expected to integrate the use of WCPT in the curriculum for effective implementation by teachers. Finally, to the researchers, they can consult the study as a guide for their studies.

Recommendations

In the light of the findings and educational implications, the researcher makes the following recommendations:

1. WCPT strategy is effective in improving students' achievement and interest in biology. Therefore, emphasis should be given to equipping students with the necessary skills in using the strategy.

2. Teacher preparation institutions should incorporate class wide peer tutoring strategy in the relevant areas of their curriculum units and expose both the pre-service and in-service teachers to these techniques of teaching and learning. This would involve instructing teachers on the basic concepts of class wide peer tutoring, the designing and development, training programs and how best to train learners in the various types of learning strategies. This exposure will help to develop in the teachers the competencies necessary for helping the students to effectively use WCPT strategy.
3. Federal and State Ministries of Education and relevant professional associations interested in the problems of learning in schools should organize free seminars /workshops and conferences for teachers on the importance of whole class peer tutoring as an aid to students learning; the designing and development of class wide peer tutoring programs, and procedures in training learners on the use of the strategy. This is necessary because many of practicing teachers may not be familiar with the skills involved in WCPT strategy, not to talk of teaching students how they can effectively apply in learning.
4. Relevant governmental agencies and professional bodies should sponsor further research on the effectiveness of class wide peer tutoring in other content areas not covered in this study

Limitations of the Study

The generalization and conclusions of the result of this study is subject to some limitations:

1. The use of RPT and WCPT modes of peer tutoring was strange to the teachers as the researcher observed during the teachers training session. Hence they relied on the orientation exercise for experience

Suggestions for Further Research

Based on the findings of this study, it became imperative to make the following suggestions for further investigations;

1. There is need to replicate the study in different geographical areas.
2. Another area of interest for further studies is in finding out whether other modes of peer tutoring will bring about more improvement in students' achievement and interest. Also studies should be done in primary schools and tertiary institutions using other modes of peer tutoring.
3. Replicating the study in other science related subjects may generate more data that may yield different result

Summary of the Study

The main purpose of this study is to determine the effect of peer tutoring strategies on students' achievement and interest in Biology. The study was guided by six research questions and six null hypotheses. Related literature was reviewed under conceptual framework, theoretical framework, review of related empirical studies and then summarized. From the empirical studies reviewed, it was ascertained that something is yet to be done on the effectiveness of WCPT and RPT peer tutoring strategies on students' achievement and interest in biology.

This study employed quasi-experimental design. Specifically, the non-equivalent control group design was adopted. The study was carried out in Onitsha Education zone of Anambra State. The population of this study comprises 6,270 SSII students in all the government owned secondary schools in Onitsha Education zone and sample of this study was 180 SSII biology students' selected using stratified random sampling technique and simple random sampling technique. Two main instruments were used for data collection in this study namely: Biology Achievement Test (BAT) and Biology Interest Scale (BIS). The BAT is a 30 item multiple- choice objective

test. Each item has four options lettered A-D. The BIS is a 16 item scale developed by the researcher using the four –point scale of strongly Agree (SA) 4 points; Agree (A) 3 points; Disagree (D) 2 points; Strongly Disagree(SD) 1 point. The items of the instrument were validated by three specialists to ensure their content and face validity. The reliability coefficient of BAT was obtained using K-R20 formula and the estimated internal consistency value was found to be 0.83. The reliability coefficient of BIS was determined with Cronbach alpha method which helped to estimate the internal consistency of 0.82. Data collected from this study were analyzed using mean and standard deviation to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significant. The result of the study shows that WCPT strategy improved students' achievement in Biology better than RPT strategy; and there was a significant difference in the mean achievement score of students taught biology when exposed to RPT and WCPT strategies with those taught using WCPT strategy having higher mean gain score. WCPT strategy improved students' interest in Biology better than RPT strategy; and there was a significant difference in the mean interest score of students taught biology when exposed to RPT and WCPT strategies with those taught using WCPT strategy having higher mean gain score. The male students had higher interest than the female students; and there is no significant difference in the mean interest scores of male and female students in Biology. There was no significant interaction effect of strategies and gender on students' achievement in Biology. Finally, there was a significant interaction effect of instructional strategies and gender on students' interest in Biology. The conclusion of the study were highlighted and it was recommended among others that biology teachers should be exposed to relevant and effective pedagogy involving the use of WCPT strategy in teaching Biology.

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APPENDIX A

2015 WAEC CHIEF EXAMINER'S REPORTS ON BIOLOGY MAY/JUNE EXAMINATION

BIOLOGY PAPER 2 MAY/JUNE 2015

General Comments

The standard of the paper compared favorably with those of the previous years. The questions were properly framed and drawn from a wide range of the syllabus. The rubrics were clear. The marking scheme was exhaustive and adequate. The performance of Candidates this year was poorer than that of last year with a raw mean score of 25 and standard deviation of 11.87 when compared with the raw mean score of 29 and the standard deviation of 12.37 of M/J 2014 WASSCE. The total number of candidates that sat for the examination was 1,182,038.

Candidates' Weaknesses

The observed weaknesses are as follows:

- wrong spelling of technical terms e.g. grass hopper, weevil for *grasshopper*, *weevil*;
- describing *photosynthesis* instead of stating how the leaf is adapted for photosynthesis;
- not attempting the compulsory question 6;
- inability to state correctly the differences between the excretion in flowering plants and excretion in humans;
- lack of sequence in the *Carbon cycle*;
- inability to define *test cross* correctly;
- making a diagram of the *Nitrogen cycle* instead of the *Carbon cycle*;
- poor crossing of the genetic expression;
- constructing a food chain without showing the direction with arrow heads;
- poor understanding of sexual reproduction in *Rhizopus*;
- poor attempt in answering questions requiring detailed explanations;
- Poor response to questions on *ecology* and *genetics*.

The following solutions were proffered to overcome these weaknesses;

- teachers should teach students how to use arrow heads to show the direction of processes in biological cycles;
- students should be taught how to answer questions correctly;
- all the aspects of the syllabus should be touched by the teacher and students;
- students should be more confident when taking examinations;
- students should read and understand a question properly before attempting it, e.g. candidates were explaining *adoption* instead of *adaptation* as required;
- students should study various textbooks not depending on their teachers' notes only;

- teachers should teach students how to make good diagrams;
- the correct definition of biological terms should be encouraged.

Candidates' Strengths

The observed strengths of the candidates include;

- ability to present their answers concisely;
- using tables as required to differentiate between the excretion in flowering plants and excretion in humans;
- ability to describe the mode of feeding in Tapeworm;
- adhering to instructions e.g. not answering question 5 which is not peculiar to their country;
- display of knowledge of some of the tested items;
- ability to state the effect and remedy of kidney stones, nephritis and diuresis;
- ability to write legibly;
- ability to state the benefits of including roughage in the diet of humans.

APPENDIX B

TABLE OF SPECIFICATION

Cognitive/objectives Topics	Knowledge.30%	Comprehension.20%	Application.25%	Analysis.15%	Synthesis.5%	Evaluation5%	Total 100%
Adaptation 10%	1 (1)	1 (4)	1 (3)	-	-	-	3
Pollution and its control 45%	4 (5,6,7,8)	3 (2,9,10)	3 (11,12,14)	2 (14,15)	1 (16)	1 (17)	14
Conservation of natural resources 30%	3 (18,19,20)	1 (23)	2 (25,30)	1 (29)	1 (27)	1 (28)	9
Association 15%	1 (20)	1 (22)	1 (24)	1 (26)	-	-	4
Total 100%	9	5	7	5	2	2	30

APPENDIX Ca**Biology Achievement Test (BAT)**

Name of school

Time: 1hr

Gender: tick male () female ()

Instruction: Answer all questions



1. The diagram above is an adaptation for_____

(a) Feeding (b) swimming (c) crawling (d) burrowing

2. The moistened skin of a tadpole is_____ type of adaptation?

(a) Structural adaptation (b) physiological adaptation (c) adaptation in function (d) adaptation for reproduction.

3. A fresh tilapia fish could not survive for hours in a dry Petri dish because of ____

(a) lack of atmospheric oxygen (b) lack of fresh air (c) lack of dissolved oxygen in water.

4. Which of the following is not a type of adaptation?

(a) Structural (b) psychological (c) physiological (d) behavioral

5. All the following are air pollutants except_____

- (a) Smoke and soot (b) fertilizers (c) dust particles (d) carbon monoxide

6. Untreated sewage is a major cause of_____

- (a) Noise pollution (b) air pollution (c) land pollution (d) radioactive pollution

7. One of the ways of controlling air pollution is _____

- (a) Ban on the use of heavy guns (b) industrial effluents should be recycled (c) tall chimneys should be installed in kitchens and industries (d) control of oil spillage

8. Which of the following best defines pollution?

- (a) Pollution is the introduction of harmful substances into the environment at the level that is harmful to living things. (b) Pollution is the introduction of perfumes into the environment. (c) Pollution is the introduction of toxic substances into the environment by human activities at the level that is harmful to living things (d) pollution is the introduction of sweet fragrance into the environment at the level that living organisms likes it.

9. One common similarity among the types of pollution is that

- (a) They are caused by pollutants (b) they are caused by animals (c) they are caused by heavy duty machines (d) they are caused by deforestations.

10. Mining activities can lead to _____type of pollution.

- (a) Air pollution (b) noise pollution (c) land pollution (d) water pollution.

11. A farmer scolds neighbors who dumps nylons and plastics in his garden, this farmer does this because

(a) Those materials cannot decay (b) those materials enriches the soil (c) those materials can decay (d) those materials prevents deforestation

12. A student living in a nearby cement factory is diagnosed of asthma. The likely cause of this diseases is_____

(a) Continuous inhalation of cement (b) continuous inhalation of carbon monoxide (c) continuous drinking of dirty water (d) continuous inhalation of carbon 4 oxide.

13. An operator of a heavy duty machine in a factory complains of his inability to hear very well. This is as a result of _____ (a) Radioactive pollution (b) drinking of excess dirty water (c) sleeping too much (d) noise pollution.

14. Which of the following groups of pollutants causes water pollution?

(a) Carbon monoxide and sulphur dioxide (b) lead dust and ammonia (c) untreated sewage and metal scabs (d) untreated sewage and fertilizer.

15. A student after drinking a cup of water scooped from village stream has running stool .This is because. (a) The water is from a natural source. (b) The water contains alum (c) the water contains chlorine (d) the water is polluted

16. What is the general name to describe the following pollutants, bottle, thin, nylon and metal scabs. (a) Biodegradable materials (b) non-biodegradable materials (c) chemical pollutants and gaseous pollutants.

17. Students should have awareness of environmental pollution because.

(a) To protect the environment (b) to fell more trees (c) to encourage bush burning (d) to upset the environment.

18. One of these is not a way of ensuring conservation of natural resources.

(a) establishment of agencies for conservation (b) establishment of game reserves or national parks. (c) Over grazing of animals.

19. Which of the following is not an example of renewable natural resources?

(a) rain (b) animals (c) copper (d) air

20. Which of the following is not a type of association?

(a) parasitism (b) commensalism (c) mutualism (d) metabolism

21. One of these best defines non-renewable natural resources

(a) the resources are produced by man (b) the resources can be recovered when exhausted (c) the resources are found in the environment (d) the resources are not revocable when exhausted

22. One major similarity between mistletoe and tape worm is

(a) both are symbionts (b) both are parasites (c) both are commensals (d) both are autotrophs

23. Deforestation can lead to the destruction of one of the following natural resources

(a) water (b) wild life (c) forest (d) soil

24. A hen clucks at the sight of hawk because, hawk is its _____ (a) prey (b) predator (c) commensals (d) host

25. Fisher men have standard size of nets for fishing. The use of such standard size of nets is to;

(a) catch all fishes (b) catch only matured fishes (c) catch only fingerlings (d) prevent all the fishes caught from escaping.

26. How can you prove that the relationship between fungus and algae is symbiotic?

(a) this is when algae benefits more than fungus (b) this occurs if only fungus benefits only (c) this is when both algae and fungus benefits (d) this occurs when algae is the host

27. Which of the following groups of resources are examples non-renewable resources?

(a) copper ,coal ,air and gold (b) copper, gold, tin and fish (c) copper, gold, tin and coal (d) copper, gold ,tin, and wildlife

28. How can you prove that some wild life are not conserved?

(a) by studying their abundant (b) by checking how frequent they are in their distribution (c) by finding out if they are rare in their distribution (d) by checking if they are evenly dispersed

29. From the following groups of natural resources, select the option that has only non-renewable resources

(a) forest, wildlife, water (b) copper, coal, crude oil (c) water, soil, air (d) copper, water, coal

30. Poachers are prevented from having access to game reserves. Which of the following can be the possible reason for such prevention?

(a) to protect animals from undue exploitation (b) to preserve plants (c) to destroy animals (d) to destroy plants

APPENDIX Cb

MARKING GUIDE FOR BAT

1. B	11. A	21. D
2. B	12. A	22. B
3. C	13. D	23. C
4. B	14. D	24. B
5. B	15. D	25. B
6. C	16. B	26. C
7. C	17. A	27. C
8. A	18. C	28. C
9. C	19. C	29. B
10. A	20. D	30. A

NOTE: Each correct item was assigned a score of 1 mark. The total scores obtained by each student was then converted to percentage. Therefore, the maximum obtainable score per student was 100.

APPENDIX D

BIOLOGY INTEREST SCALE (BIS)

Biology Interest Scale (BIS)

Instructions: This instrument is aimed at finding out the extent to which you are interested in senior secondary school biology. You are required to indicate for each activity the extent of your interest on the right hand of each page by a tick (✓) as follows:

SA - Strongly Agree

A - Agree

D - Disagree

SD- Strongly Disagree

S/N	ITEM STATEMENTS	SA	A	D	SD
1.	I feel uncomfortable during biology lessons.				
2.	I take part in asking questions in biology classes.				
3.	I am always happy whenever I solve biology problems correctly.				
4.	I always enjoy studying biology in school				
5.	I like solving biology problems.				
6.	I like to put in more efforts in solving biology problems.				
7.	I teach biology to my fellow students.				
8.	I do all my corrections on biology concepts that I failed during classroom task.				
9.	I enjoy asking questions during biology lessons.				
10.	I hate reading biology text books.				
11.	I feel nervous doing biology experiment.				
12.	Lessons in biology makes me boring.				
13.	I compete with other students for high scores in biology.				

14.	I do not participate in group activities in biology.				
15.	I don't do my assignments in biology.				
16.	I pay attention in biology lessons more than any other science subjects.				

APPENDIX E

RELIABILITY OF BIOLOGY ACHIEVEMENT

Computation of the Reliability of Biology Test

ITEMS	R	W	P	Q	PQ
1	20	10	0.67	0.33	0.22
2	22	8	0.73	0.27	0.20
3	21	9	0.70	0.30	0.21
4	21	9	0.70	0.30	0.21
5	27	3	0.90	0.10	0.09
6	18	12	0.60	0.40	0.24
7	13	17	0.43	0.57	0.25
8	19	11	0.63	0.37	0.23
9	26	4	0.86	0.14	0.12
10	20	10	0.67	0.33	0.22
11	28	2	0.93	0.07	0.07
12	20	10	0.67	0.33	0.22
13	30	0	1.00	0.00	0.00
14	15	15	0.50	0.50	0.25
15	27	3	0.90	0.10	0.09
16	23	7	0.77	0.23	0.25
17	29	1	0.96	0.04	0.04
18	26	4	0.86	0.14	0.12
19	25	5	0.83	0.17	0.14
20	23	7	0.76	0.24	0.18
21	26	4	0.86	0.14	0.12
22	24	6	0.80	0.20	0.16
23	17	13	0.57	0.43	0.25
24	22	8	0.75	0.25	0.19
25	11	19	0.36	0.64	0.19
26	9	21	0.30	0.70	0.24
27	23	7	0.76	0.24	0.18
28	10	20	0.33	0.67	0.22
29	21	9	0.70	0.30	0.21
30	27	3	0.90	0.10	0.09
					5.20

- R = Number of Examinees that choose correct option
- W = Number of Examinees that choose wrong options
- P = Proportion of Examinees that choose correct option
- Q = Proportion of Examinees that choose wrong options
- PQ = Product of proportion of those that choose correct option and those that choose wrong options

$$K-R_{20} = \frac{n}{n-1} \left[1 - \frac{\sum pq}{S_t^2} \right]$$

Where n = number of items

$\sum pq$ = Sum of the product of proportion of those that choose correct option and those that choose wrong options

S_t^2 = Variance of total items

$$= \frac{30}{30-1} \left[1 - \frac{5.20}{27.37} \right]$$

$$= \frac{30}{29} (1 - 0.19)$$

$$= 1.03 (0.81)$$

$$= 0.8343$$

$$\approx 0.83$$

APPENDIX F

Reliability Output for Biology Interest Scale (BIS)

Case Processing Summary

	N	%
Valid	30	100.0
Cases Excluded ^a	0	.0
Total	30	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.82	16

APPENDIX G

**POPULATION DISTRIBUTION OF SENIOR SECONDARY SCHOOL TWO (SSS2)
STUDENTS AND SCHOOLS IN ONITSHA EDUCATION ZONE OF ANAMBRA
STATE**

**GOVERNMENT OF ANAMBRA STATE OF NIGERIA
POST PRIMARY SCHOOLS SERVICE COMMISSION**



Zonal Office
11 Park Road, G.R.A
P.M.B. 1502 Onitsha

E-mail: pposscozhaz400@gmail.com

Our Ref: _____

Your Ref: _____

Date _____

LIST OF SCHOOLS IN ONITSHA ZONE

S/NO	NAME OF SCHOOLS	BOYS	GIRLS	REMARK
	ONITSHA NORTH LGA			
1.	DENNIS MEMORIAL GRAMMER SCHOOL ONITSHA	164		
2.	ANGLICAN GIRLS' GRAMMER SCHOOL, ONITSHA		244	
3.	QUEEN OF THE ROSARY COLLEGE, ONITSHA		257	
4.	ADO GIRLS' SECONDARY SCHOOL, ONITSHA		303	
5.	ST. CHARLES COLLEGE, ONITSHA	194		
6.	EASTERN ACADEMY ONITSHA		320	
7.	NEW ERA GIRLS SECONDARY SCHOOL, ONITSHA		350	
8.	INLAND GIRLS SECONDARY SCHOOL, ONITSHA		350	
9.	WASHINGTON MEMORIAL GRAMMAR SCHOOL, ONITSHA	114	94	
10.	PATTERSON MEMORIAL GRAMMER SCHOOL, ONITSHA	109		
11.	PRINCE MEMORIAL HIGH SCHOOL, ONITSHA	163	100	
12.	ARMY DAY SECONDARY SCHOOL, ONITSHA	147	77	
13.	METROPOLITAN COLLEGE, ONITSHA	160	32	
14.	GOVERNMENT TECHNICAL COLLEGE ONITSHA	280	9	
15.	ONITSHA HIGH SCHOOL, ONITSHA	110	141	
16.	OUR LADYS' HIGH SCHOOL, ONITSHA	100	47	
	Total	1541	2424	
	ONITSHA SOUTH LGA			
17.	CHRIST THE KING COLLEGE, ONITSGHA	323		
18.	URBAN GIRLS' SECONDARY SCHOOL, ONITSHA		402	
19.	URBAN BOYS' SECONDARY SCHOOL, ONITSHA	184		
20.	METU MEMORIAL SECONDARY SCHOOL, ONITSHA	140	67	
21.	MODEBE MEMEMORIAL SECONDARY SCHOOL, ONITSHA	198	103	
22.	SPECIAL SECONDARY SCHOOL FOR THE DEAF, ONITSHA	9	5	
	Total	854	577	
	OGBARU LGA			
23.	OGBARU HIGH SCHOOL, OGBAKUBA	24	34	
24.	IDEKE GIRL' SECONDARY SCHOOL, ODEKPE	75	133	
25.	COMMUNITY HIGH SCHOOL, OKPOKO (COMM. G.S.S OKPOKO)	3	19	
26.	COMMUNITY BOYS' SECONDARY SCHOOL, OKPOKO	10	5	
27.	COMMUNITY SECONDARY SCHOOL, ATNI	35	80	
28.	GOVERNMENT TECHNICAL COLLEGE, OSSOMALA	50	30	
29.	COMMUNITY SECONDARY SCHOOL, IYIOWA ODEKPE	65	46	
30.	JOSEPHINE ODUJA MEMORIAL SECONDARY SCHOOL, AKILI-OZIZOR	10	16	
31.	UNITY COMPREHENSIVE GIRLS' HIGH SCHOOL, OKPOKO	71	114	
32.	ANTHONY OBAZE MEMORIAL SECONDARY SCHOOL, OCHUCHE UMUODU	14	10	
	Total	357	517	

Mrs. Okeke Chinwe .A.
HOD Admin
For: Zonal Director of Education
PPSSC
Onitsha Zone.

APPENDIX H

LIST OF SAMPLED SCHOOLS

S/No	Group	Names of Schools	Number of Students According to Gender in the Intact Science Classes Used	
			Number of Males	Number of Females
1	Experimental	Army Day Secondary School, Onitsha	13	17
2		Metu Memorial Secondary School, Onitsha	15	15
3		Ideke Girls Secondary School, Odekpe	14	16
4	Control	Washington Memorial Grammar School, Onitsha	14	16
5		Modebe Memorial Secondary School, Onitsha	18	12
6		Community Secondary School, Odekpe	14	16
		Total	88	92

APPENDIX I**BIOLOGY CURRICULUM FOR SENIOR SECONDARY SCHOOL TWO**

APPENDIX J

LESSON PLAN ON PEER TUTORING USING (WCPT).

LESSON ONE: NOTE OF LESSON FOR TREATMENT GROUP

Class: SSII

Subject: Biology

Topic: Adaptation in form and function of living organism due to environmental conditions

Age: 15+

Duration: 45 minutes

Previous knowledge: peer tutor should enquire what the students peers knows about adaptation.

Instructional materials: chart, chalk, lesson notes and chalkboard.

Specific objectives: At the end of the lesson, the students should be able to:

- 1) Define adaptation.
- 2) Explain adaptation in form and functions of living organisms due to environmental condition.
- 3) State three types of adaptation.
- 4) Explain with examples one of the types of adaptations listed above.

CONTENT DEVELOPMENT	TEACHERS ACTIVITIES	PEER TUTOR ACTIVITIES	PEER ACTIVITIES	STRATEGY
Step 1 Introduction. The first tutor	Helps students develop deeper understanding of their roles as learners	The Peer tutor asks the tutees to examine an uprooted herbaceous plant and ask them what they observed. From the tutees response	They respond presence of roots, green leaves	Set induction ,Explanation, Questioning Use of examples

		he/she introduces the topic as adaptation.		
Step 2 Definition of adaptation. Second tutor		The tutor explains that adaptation is the process, by which an animal or plant species becomes fitted to its environment and writes on the board.	They ask questions and jots down points.	Explanations, use of examples
Step 3 Adaptation in form and function of living organism due to environmental conditions. The third tutor		The tutor explains adaptations in forms as any change in structure or function of an organism or any of its parts that makes an organism better fitted to survive and multiply in its environment .e.g. trees may have thick barks to protect them from wildfires. Adaptations in functions is that which helps an organism to survive that is the way the organism carry out some activities e.g in plants this means anything that helps them carry out major life functions such as photosynthesis, water and nutrient storage and growth.	They pays attention to what the tutor is saying	Use of examples.
Step 4 Types of adaptation. The fourth tutor		There are three types of adaptations such as structural, physiological, and behavioral adaptations.		
Step 5 Explanations of the types. The fifth tutor	Teacher monitors the entire activities by giving corrections where it is necessary.	i) Physiological adaptation is based on body chemistry and metabolism; it usually doesn't show from the outside that is it shows from inside. E.g. desert kangaroo rats possess efficient kidneys for water conservation, presence of toxins in plants leaves to repel herbivores. ii) Structural adaptations.	The peers answers the tutors' questions and ask theirs	Questioning, planned repetition

		This involves the features an organism possesses outside their body that will enable them live successfully e.g. trees may have tick backs to protect them from wildfires iii) Behavioral adaptations: This is the type that shows how an organism acts e.g. Lizards seek a sunny spot in the morning to warm up to operating temperatures.		
Step 6 Evaluation. The sixth tutor evaluates and summarizes the lesson		The tutor evaluates the tutees with the following questions. 1. Define adaptations. 2. Explain adaptation in form and functions of living organisms due to environmental conditions 3. State three types of adaptations 4. Explain one of the types of adaptations listed above.	They answers the tutors question and ask theirs.	questioning
Conclusion/closure		The peer tutor will summarize the lesson of the day by highlighting some of the major points of the lesson and gives them assignment.		

LESSON PLAN ON PEER TUTORING USING (WCPT)

NOTE OF LESSON FOR TREATMENT GROUP

LESSON TWO

Class: SSII

Subject: Biology

Topic: Adaptation (Structural adaptations of tadpole, fish and birds)

Duration: 45 minutes

Age 15⁺

Previous knowledge: The students have learnt adaptation and its modifications

Instructional materials: Lesson notes, charts, Chalk, and board

Specific objectives: At the end of the lesson, the students should be able to:

- (1) State the structural adaptations of tadpole and fish to life in water.
- (2) List the kinds of birds with feeding modifications
- (3) Describe the adaptive structures found in the above kinds of birds
- (4) Discuss at least three adaptive structures found in their feet and beaks.

CONTENT DEVELOPMENT	TEACHERS ACTIVITIES	PEER TUTOR ACTIVITIES	PEER ACTIVITIES	STRATEGY
Step 1 Introduction. The first tutor	Helps students develop deeper understanding of their roles as learners.	The tutor asks the tutees to explain how domestic fowl feeds. From their responses he/she introduces the topic as structural adaptation in some organisms.	They respond by saying scratching the ground.	Set induction, use of examples
Step 2 Structural adaptations in fish and tadpoles. Second tutor		The tadpoles and fish shows the following structural adaptations to life in water as; i. Both have streamlined body shape without neck that enables them to move easily through water. ii. The tail and tailfin of a fish are special adaptive	They pay attention to the tutor and nod their heads and jot down points.	

		structures for swimming. The tadpole too has a fish-like tail and tail fin which enables it to swim. iii. Gills are gaseous exchange organs that are adapted for an aquatic environment. They are found in both fishes and tadpoles.		
Step 3 Kinds of birds. Third tutor		The tutor lists the kinds of birds as: carnivorous birds, grain eating birds, filter-feeding birds, insect eater's birds; nectar sucking birds, fish eaters, and seed eaters.	They smiles	Use of examples and explanations.
Step 4 Diagrams of adaptive structures found in bird's beaks and feet. The fourth tutor.			They observe the diagrams and draws theirs	
Step 5 Evaluation. The sixth tutor evaluates and summarizes the lesson	The teacher guides the entire activities by reinforcing the students and giving corrections.	The tutor evaluates the tutees with the following questions - List the kinds of bird and feeding modifications. - Describe their adaptive structures found in above - Draw at least three adaptive structures found in their feats and fishes to life in water	They answers the tutors questions and ask theirs	Questioning, planned repetition
Conclusion/closure		The tutor summarizes the lesson of the day by highlighting some of the major points of the lesson and gives the tutees assignment		

LESSON PLAN ON PEER TUTORING USING (WCPT).

NOTE OF LESSON FOR TREATMENT GROUP

LESSON THREE

Class: SS11

Subject: Biology

Topic: Pollution (pollution of the atmosphere air pollution)

Duration: 45 minutes

Age: 5+

Previous knowledge: The peer tutor should enquire what the tutees know about pollution.

Instructional materials: Diagrams, lesson notes, chalk, board

Specific Objectives: At the end of the lesson, the student should be able to.

1. Define pollution
2. Describe air pollution and their nature.
3. List air pollutants and their sources.
4. Explain at least three effects and control of air pollution
5. List at least three sources and effects of noise pollution
6. Explain at least two control of noise pollution.

CONTENT DEVELOPMENT	TEACHERS ACTIVITIES	PEER TUTORS ACTIVITIES	PEERS ACTIVITIES	STRATEGY
Step 1 Introduction. The first tutor	Helps students develop deeper understanding of their roles as learners	The tutor asks the students what is pollution? This will lead us to our today's lesson pollution.	They answer contamination of land, water, soil	Set induction, use of example, explanations, questioning.
Step 2 Definition of pollution. The second tutor		Pollution is defined as the release of toxic or harmful substances into the	They observe their tutor and jot down	

		environment by their natural forces or man and other animals to an extent that causes biological damage to man and his resources. Those things that cause pollutions are called pollutants.	points	
Step 3 Description of air pollution and their nature. The third tutor		This is the introduction or release of harmful substances into the atmosphere. It can be in solid, liquid and gaseous forms.	They ask questions	Use of examples
Step 4 Air pollutants and sources. The fourth tutor		Air pollutant includes the following such as carbon monoxide, nitrogen oxide, dust particles, soot and smoke, radio-active rays. Sources: burning of fuel in cars, coal mining and cement industries, electrical discharge in air.	They pay attention to the tutor and jot down points	Explanations
Step 5. Effects and control of air pollution. The fifth tutor		The effects of air pollution are as follows: i. It causes impaired health as the irritation of eyes, lungs and skin. ii. It causes acid rain.	They note their heads and jot down points	

		iii. Dust particles reduce visibility. iv. Sooth can cover the leaves of plants thereby reducing photosynthesis. v. Nitrogen oxide can form nitric acid with water in air to form acid rain which corrodes metallic objects. Control: i. Tall chimneys should be installed in kitchens and industries. ii. Legislation should be made against indiscriminate burning that may bring about smoke. iii. Industries should be sited for away from residential buildings.		
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		iv. Conditions must be checked for complete combustion of fuel in internal combustion engines.		
Step 6 sources and effect of noise pollution. The first tutor comes back		The peer tutor also explains to the tutees that noise pollutants include factories or industrial noise, Aeroplane or aviation noise, railway engine or locomotive noise, car horns and sirens, high pitched musical sounds from loud speakers. Effects: It causes loss of hearing or deafness. i) It causes general irritation or short temperateness. ii) It can cause changes in behavior.	They give most of the examples of noise pollution	Use of examples
Step 7 control of Noise pollution. The second tutor		The control measures include: i. Legislation should be made against the use of loud speakers, ii. There should be		

		reduction of noise from loud speakers and car sirens. iii. Ban on the use of heavy guns v. Railways and air ports should be sited far away from residential areas.		
Step 8 Evaluation and summary. The third tutor	The teacher guides the whole activities of tutors and tutees and gives corrections where is necessary.	The tutor evaluates the tutees with the following questions. 1. Define pollution 2. Describe air pollution and their nature 3. List air pollutants and sources 4. Explain at least three effects and control of air pollution 5 list at least three sources and effects of noise pollution. 6. Explain at least two controls of noise pollution.	They answers the tutors questions and ask theirs	Questioning
Summary closure		The tutor summarizes the lesson by recasting the major points in the lesson and gives assignment.		

LESSON PLAN ON PEER TUTORING USING (CWPT).

NOTE OF LESSON FOR TREATMENT GROUP

LESSON FOUR

CLASS: SS II

Subject: Biology

Topic: Pollution (Water and Soil Pollution).

Duration: 45 minutes Age 15

Precious knowledge: tutees have learnt air and noise pollutions.

Instructional materials: Diagrams, chalk, lesson notes and chalk board

Specific objectives: At the end of the lesson, tutees should be able to:

1. Describe land pollution
2. State at least three pollutants and sources of land pollution
3. Describe at least two effects and control of soil pollution
4. List at least three sources and pollutants of water pollution
5. Describe at least three effects and control of water pollution

CONTENT DEVELOPMENT	TEACHERS ACTIVITIES	PEER TUTORS ACTIVITIES	PEERS ACTIVITIES	STRATEGY
Step 1 Introduction. The first tutor	Helps students develop deeper understanding of their roles as learners	The tutor asks the students how does a polluted water looks like this will lead us to the topic of today's lesson water pollution and soil pollution from their responses he/she introduces the topic as land and water pollution..	They respond by saying it Smells, change in color	Set induction, use of examples

Step 2 Description of land pollution. The second tutor		Water pollution is the contamination of water bodies, usually as a result of human activities. Water bodies includes lakes, rivers, oceans etc.		
Step 3 Pollutants and sources of land pollution. The third		Land pollutants includes, refuse, sewage, metal scraps, chemicals, oil spillage. Sources: from homes, offices, abandoned vehicles and machines, oil drillings, markets etc.	They pays attention to the tutor and jots down points.	Use of examples, verbal cuing
Step 4 Effects and control of land pollution. The fourth peer tutor		The peer tutor went further to itemize the effects as: i) It causes offensive odor when the refuse decay. ii) Sewage can cause respiratory disorder iii) This can cause breeding ground for diseases .iv) Excess fertilizers can cause soil acidity and can cause the death of aquatic organisms. v) Metals occupies land spaces. Control: i) Refuse should be burnt in incinerators.		

		ii) ii) Urban waste should be properly burnt or buried iii) iii) Legislation should be made by governments. iv) Metal soaps, tins, bottles, motor vehicles parts should be recycled.		
Step 5 pollutants and sources of water pollution. The fifth peer tutor		The pollutants of water include; sewage, pesticides and fertilizers, chemical waste, excreta or feces, oil spillage. Sources: This includes city sewage systems, industries and ships at harbors, human and animals, oil drilling etc.	They pays attention to the tutor and ask questions	Use of examples, planned repetitions
Step 6 Effects and control of water pollution. The first peer tutor comes back		The peer tutor went further to explain the effects as i. It makes water unfit for human consumption ii. It supports the growth of pathogens that can cause diseases e.g. cholera. iii. The can kill aquatic organisms iv. They produce unpleasant odors.	They jots down points.	

		Control: i) There should be efficient techniques to deal with or prevent oil spillage ii) There should be efficient and proper sewage disposal system. iii) Industrial effluents should be recycled. iv) Government or local authorities should strictly monitor all industrial wastes.		
Step 7 Evaluation. The second peer tutor comes back to evaluate the tutees by asking them questions, then from their responses he/she summarizes the lesson and gives them assignment.	The teachers guides the entire activities of the students.	The tutor evaluates the tutees with the following questions. i. Describe land pollution ii. State at least three pollutant and sources of land pollution. iii. Describe at least two effects and control of soil pollution iv. List at least three sources and pollutants of water pollution v. Describe at least there effects and controls of water pollution.	Tutees answers the tutors questions	Questioning

Conclusion/closure		The peer tutor summarizes the lesson by highlighting some of the major points of the lesson		
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LESSON PLAN ON PEER TUTORING USING (WCPT).

NOTE OF LESSON FOR TREATMENT GROUP

LESSONFIVE

CLASS: SS II

Subject: Biology

Topic: Association (types of association).

Duration: 45 munities

Previous knowledge; Peer tutor should enquire what the student-peers knows about association.

Age: 15+

Instructional Materials: Diagrams, chalk, lesson notes, and chalkboard.

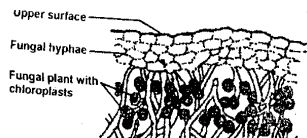
Specific objectives: At the end of the lesson, tutees should be able to;

1. Define association
2. List the types of associations
3. Explain at least one type of association with an example listed above.
4. Draw a diagram to illustrate symbiotic association

CONTENT DEVELOPMENT	TEACHERS ACTIVITIES	PEER TUTORS ACTIVITIES	PEERS ACTIVITIES	STRATEGY
Step 1 Introduction. The first tutor.	Helps students to have deeper understanding of their roles as learners	The peer tutor introduces the lesson by asking the tutees how you interact with one another. From their responses he/she introduces the lesson as association	They answers by giving, receiving.	Set induction, use of examples
Step 2		This is a group of	They ask	Planned

Definition of association. The second tutor		organisms (plants and animals) that live together in a certain geographical region and constitute a community with a few dominant species.	questions and listens to the peer tutor	repetition
Step 3 Types of association. the third peer tutor		There are five main types of associations namely, symbiosis, commensalism, parasitism, predation and competition.	They listens to the tutor and jots down points.	
Step 4 Explanations of the types of association. the fourth peer tutor		1) Symbiosis is a close association between two organisms on which both of them benefits from each other. Each member is called symbiont. Examples i) Alga and fungus in lichen, ii) Protozoa in the intestine of termites iii) Bacteria in the rumen of ruminants. 2) Commensalism: This is an association between two organisms living together in which only one (commensal) benefits from the association while the other is neither benefited nor harmed.	They watch the tutor and jots down points.	Explanations, use of examples.

		Examples i) Remora fish and shark ii) Oyster and crab. iii) Man and intestinal bacteria. 3) Parasitism: This is a close association between two organisms in which one, known as the parasite lives in or on and feeds at the expense of the other organism which is known as the host example - i). Man and the tapeworm, ii) Mistletoe and flowering plant. 4. Predation; Is an association between two organisms in which the predator kills the other called the prey. Examples: i) The hawk and domestic fowls - ii). The lion and goat. 5. Competition: This involves the interactions among two organisms of the same or different species which one outgrows the other and survives while the other can neither grow nor survive. When competition is between		
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		members of the same species it is called intra specific competition while it is called inter- specific competition of it is between members of different species.		
Step 5 Diagram of symbiotic association. The fifth tutor		The tutor shows the tutees the diagram of a lichen, and went further to explain 	They observe the diagram and draws theirs.	Use of examples.
Step 6 Evaluation. The first tutor comes back to evaluates the students by asking them questions	The teacher guides the activities of teaching and learning.	The Peer tutor evaluates the tutees with the following questions - Define association - list the types of association - Explain at least one type of association with example. - Draw a diagram to illustrate symbiotic association Conclusion/closure; The peer tutor summaries the lesson by highlighting some of the major points of the lesson. And gives them assignment	They answers the tutors questions and ask theirs	Questioning

LESSON PLAN ON PEER TUTORING USING (WCPT).

NOTE OF LESSON FOR TREATMENT GROUP

LESSON: Six

CLASS: SSII

Subject: Biology

Age: 15⁺

Topic: Association (features of biological importance possessed by organisms of an association)

Duration: 45 minutes

Previous knowledge: The tutors have learnt types of association

Specific objectives: by the end of the lesson the tutees should be able to:

1. List two features of biological importance possessed by organisms in symbiotic association.
2. State two features of biological importance possessed by organisms in commensalism association
3. List one feature of biological importance possessed by organisms in parasitic association.
4. State two features possessed by organisms in predation association.

CONTENT DEVELOPMENT	TEACHERS ACTIVITIES	PEER TUTOR ACTIVITIES	PEER ACTIVITIES	STRATEGY
Step 1. Introduction. The first tutor	Helps students to have a deeper understanding of their roles as learners.	Students have you seen a lichen before? This will lead us to our today's lesson, features of biological importance possessed by some organisms.	They answers yes, no	Set induction, use of examples, explanation.
Step 2. Features of biological importance possessed by organisms in symbiotic association		Lichen is the combination of fungus and algae living together. It is a mutual relationship. Here the biological importance is that algae has green pigments (chloroplast) which helps to synthesize food while the	They listens to the tutor and jots down points.	Explanation

(lichen).The second tutor		fungus has hyphae which helps to absorb nutrient there by encloses and protects the algae from physical damage.		
Step 3. Features of biological importance in commensalism association (oyster and crab). The third tutor		Here only one organism benefits while the other is neither harmful nor beneficial. A case study of oyster and crab. The oyster has shell and gills which serves as a habitat for the crab: while it is not gaining or loosing anything from the crab.	The tutees ask questions.	Use of examples.
Step 4. Biological features in parasitic association. The fourth tutor		A case study of mistletoe and flowering plants. The tutor, with the aid of the diagram on the chart went further to explain that; the mistletoe has haustorium through which they extract water and nutrient from the host plant.	They draws the diagram and pays attention to the tutor	Explanations
Step 5. Competitive association. The fifth tutor		The fifth tutor went further to explain to the tutees with the aid of a diagram.Example is the hawk and chicks the hawk is bigger than chicks with sharp beaks and toe used for capturing and tearing the chicks.	They observe the diagram and ask questions.	Use of examples.
Step 6. Evaluation. The sixth tutor	The teacher guides the activities of tutors and tutees by giving corrections and praise where is necessary.	The sixth peer tutor evaluates the tutees with the following questions 1. List two features of biological importance possessed by organisms in symbiotic association. ii. State two features of biological importance possessed by organisms in commensalism association iii. List one biological features of biological	Peers answers tutees questions and ask theirs if they have any.	Questioning.

		importance possessed by organisms in parasitic association. Iv state two biological importance possessed by organisms in predation association. The tutor summarizes the lesson with the tutees answers and gives them a take home assignment.		
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LESSON PLAN ON PEER TUTORING USING (WCPT).

NOTE OF LESSON FOR TREATMENT GROUP

LESSON SEVEN

Class: SS II

Subject: Biology

Topic: Conservation of natural resources

Age 15+

Duration: 45 Munities

Previous knowledge: The peer tutor should enquire from the students what they know about conservation of natural resources.

Instructional materials: Diagrams, chalk, lesson notes and chalk board

Specific objectives: At the end of the lesson, the tutees should be able to:

1. Define the term conservation of natural resources
2. State the two types of conservation of natural resources.
3. List and explain at least four ways of ensuring conservation of natural resources

CONTENT DEVELOPMENT	TEACHERS ACTIVITIES	PEER TUTORS ACTIVITIES	PEERS ACTIVITIES	STRATEGY
Step 1 Introduction. The first tutor	Helps students develop deeper understanding of their roles as learners	The first tutor what they understand by resources, with the tutees responses he/she introduces the lesson and writes the topic on the board.	They said such as air, water, forest soil etc.	Set induction, use of examples etc.
Step 2 Definition of conservation of		Conservation of natural resources is the prevention of	They pays attention to the	Explanations.

natural resources. The second tutor.		natural resources from loss, waste or exploitation through rational use and to ensure their continued use or availability and preserve the quality or original nature of natural resources.	tutor and jots down points.	
Step 3 types of conservation of natural resource. The third tutor.		The third tutor explains the types as ;i) Renewable natural resources as the ones that are renewable e.g. rain, animals, plants, water, air etc. ii) Non- renewable as the ones which when exhausted cannot be replaced or recovered e.g. petroleum, coal, tin, copper etc.	They jots down points and ask questions.	Use of examples and explanations.
Step 4 Ways of ensuring conservation of natural resources. The fourth tutor.		The fourth tutor starts by listing them as: i) Establishment of agencies for conservation: Agencies are established to ensure that these natural resources are conserved examples of those agencies are i Forest departments. ii Ministries of agriculture iii) Nigerian conservation	They notes their heads and jots down points.	Explanations and use of examples.

		foundation. 2) Establishment of game reserves or national parks. The game reserve serves for promotion of wildlife, rare or endangered species and for recreational purposes as well as scientific purposes. E.g. Borgu game reserve in Niger State. 3) Conservation education: This serves to inform the populace about the need to conserve natural resources and the consequences of examination or exhaustion of such resources like trees, wild life and minerals. 4. Making conservation laws, edicts or decrees: They are made by government to regulate the feeling of trees, hunting of endangered species or indiscriminate exploitation of mineral resources. 5. Setting standards for pollution control: These protect land, water and air resources from certain level of pollutions from industries,		
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		vehicles, power plants and homes.		
Step 5. Evaluation. The fifth peer tutor	The teacher gives corrections where it is necessary.	The fifth peer tutor evaluates the tutees with the following questions. 1. Define the term conservation of natural resources. 2. State the two types of conservation of natural resources 3. List and explain at least four ways of ensuring conservation of natural resources.	Tutees answers tutors questions and ask theirs.	Questioning
Conclusion/Summary		The peer tutor summarizes the lesson by highlighting some of the major points of the lesson and concludes the lesson by giving them take home assignment		

LESSON PLAN ON PEER TUTORING USING (WCPT).

NOTE OF LESSON FOR TREATMENT GROUP

LESSON EIGHT

Class: SS II

Subject: Biology

Topic: Benefits of conservation of natural resources

Duration: 45 minutes

Age: 15+

Previous knowledge: students have learnt conservation of natural resources.

Instructional materials: Diagrams, chalk, lesson notes, and chalk board.

Specific objectives: At the end of the lesson, tutors should be able to:

1. State at least three benefits of wildlife conservation
2. State at least three benefits of water resource conservation
3. List at least four benefits of forest resources conservation
4. Enumerate at least three benefits of social resources conservation.
5. State at least two benefits of Air resource conversation

CONTENT DEVELOPMENT	TEACHERS ACTIVITIES	PEER TUTORS ACTIVITIES	PEERS ACTIVITIES	STRATEGY
Step 1 Introduction. The first peer tutor.	Helps students to understand their roles as students	The peer tutor asks the students are natural resources useful to us? This will lead us to today's topic benefits of natural resources and he/she	Some tutors responded yes, some said no.	Set induction, use of example

		writes it on the board.		
Step 2 Benefits of wild life conservation. The second peer tutor.		i) It provides food for human consumption, e.g. meat, fish ii) It generates revenue for government. iii) It can serve as tourist centers for pleasure and relaxation iv) It provides research work for scientist. v) It can generate employment for some people.	They ask questions.	Use of examples.
Step 3 Benefits of water resources conservation.		i. It serves as sources of food supply, e.g. fish, prawns, and crayfish. ii. It serves as medium for transportation in rivers, lakes. iii. It provides employment for people e.g. fishermen, canoe or ship builders. iv. It is useful for domestic and industrial uses e.g. dinking, washing, cooking etc. v. it is used for hydroelectric power generation which provides electricity		

		e.g. kanji dam		
Step 4 Benefits of forest resource conservation. The fourth peer tutor.		i) It serves as wind break. ii) They are homes or habitats of wild animals which can serve as game reserves. iii) It provides medicinal herbs iv) It is the sources of timber for construction purposes v) They are sources of (fuel) fire wood used for cooking.	They listens to the tutor and jots down points.	Use of examples.
Step 5. Benefits of soil resources conservation. The fifth peer tutor.		The fifth tutor lists them out as: i. Soil supports agricultural or farming activities. ii. Building are erected on the soil iii. It is the home for some organisms iv. Soil supports wildlife resources. v. Soil also supports forest and its resources.	They jots down points from the explanations of the tutor.	Use of examples.

		vi. Mineral resources are obtained from the soil.		
Step 6. Benefits of air resource conservation. The sixth peer tutor.		The sixth tutor explains the examples as; 1) Air provides oxygen used in respiration by plants and animals. ii) It is habitat for some organisms e.g. birds, insects iii) Provides gaseous nitrogen used by plant to manufacture proteins. iv) It provides carbon dioxide used by plants for photosynthesis.	Use of examples and explanations.	
Step 7. Evaluation. The first peer tutor comes back to evaluate the tutees.	The teacher guides the entire activities of both tutors and tutees.	The peer tutor evaluates the tutees with the following questions: (i) State at three benefits of wild life conservation (ii) State three benefits of water conservation (iii) Sate four benefits of forest resource conservation. (iv) Enumerate three benefits of soil resource conservation (v) State two benefits of air resources conservation	They answers the tutors questions and ask theirs	Questioning

Conclusion/closure		The peer tutor summarizes the lesson of the day by highlighting some of the major points of the lesson and gives hem assignment.		
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APPENDIX K

LESSON PLAN ON PEER TUTORING USING (RPT)

NOTE OF LESSON FOR CONTROL

LESSON ONE

Class: SSII

Subject: Biology

Topic: Adaptation in form and function of living organism due to environmental conditions

Duration: 45 minutes

Previous knowledge: The peer tutor should enquire what the peers know about adaptation.

Instructional materials: Diagrams, chalk, lesson notes and chalkboard.

Specific objectives: At the end of the lesson, the students should be able to.

- 1) Define adaptation.
- 2) Explain adaptation in form and functions of living organisms due to environmental condition
- 3) State the three types of adaptations.
- 4) Explain one of the types of adaptations listed above.

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITIES	PEERS ACTIVITIES	STRATEGY
Step I Definition of adaptation. The first group representative.	The tutor explains that adaptation is the process, by which an animal or plant species becomes fitted to its environment.	They pay attention to the teacher and ask questions if they have any.	Explanations, Use of examples.
Step 2. Adaptation in form and function of living organism due to environmental conditions. The second tutor	The tutor explains adaptations in forms as any change in structure or function of an organism or any of its parts that makes an organism better fitted to survive and multiply in its environment .e.g. trees may have thick barks to protect them from wildfires. Adaptations in functions is that which helps an organism to survive that is the way the organism carry out some activities e.g in plants this means anything that helps them carry out major life functions such as photosynthesis, water and nutrient storage and growth.	They ask questions and jot down points	Use of examples.
Step 3. Types of adaptation. The third tutor	There are three types of adaptations such as structural, physiological, and behavioral adaptations.		Explanations.

Step 4. Explanations of the types. The fourth peer tutor.	The peer tutor went ahead to state the explanation as; i) Physiological adaptation is based on body chemistry and metabolism; it usually doesn't show from the outside that is it shows from inside. E.g. desert kangaroo rats possess efficient kidneys for water conservation, presence of toxins in plants leaves to repel herbivores. iv) Structural adaptations. This involves the features an organism possesses outside their body that will enable them live successfully e.g. trees may have tick backs to protect them from wildfires v) Behavioral adaptations: This is the type that shows how an organism acts e.g. Lizards seek a sunny spot in the morning to warm up to operating temperatures.	They pays attention to the tutor and jots down points.	Use of examples.
Step 5. Evaluation. The fifth group representative.	The tutor 5 peer tutor evaluates the tutees with the following questions. 1. Define adaptations. 2. Explain adaptation in form and functions of living organisms due to environmental conditions 3. State three types of adaptations 4. Explain one of the types of	Questioning	The tutees answers the tutors questions and ask theirs.

	adaptations listed above.		
Conclusion/closure	The tutor summarizes the lesson of the day by highlighting some of the major points of the lesson and concludes by giving them assignment.		

NOTE OF LESSON FOR CONTROL GROUP
LESSON PLAN ON PEER TUTORING USING (RPT)

LESSON TWO

Class: SS11

Subject: Biology

Topic: Adaptation (Structural adaptations of tadpole, fish and birds)

Duration: 45 minutes

Age 15⁺

Previous knowledge: The tutees have learnt adaptation and its modifications

Instructional materials: Lesson notes, Diagrams, Chalk, and board

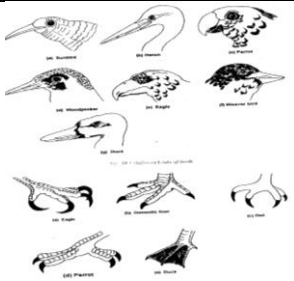
Specific objectives: At the end of the lesson, the tutees should be able to:

- (5) State the structural adaptations of tadpole and fish to life in water.
- (6) List the kinds of birds with feeding modifications
- (7) Describe the adaptive structures found in the above kinds of birds
- (8) Discuss at least three adaptive structures found in their feet and beaks.

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITIES	PEERS ACTIVITIES	STRATEGY
Step 1 Introduction. The first group representative/tutor.	The first tutortutor asks the students to explain how domestic fowl feeds with their responses, he/she introduces the lesson and writes it on the board.	They responded by saying scratching the ground.	Set induction, questioning.
Step 2 Structural adaptations in fish and	The second tutor went further to explain to the students that tadpoles and fish shows the following structural adaptations to	They listens to the tutor and jots down points.	Explanations.

tadpoles. The second peer tutor.	life in water as; The second tutor lists the characteristics as; i)Both have streamlined body shape without neck that enables them to move easily through water. ii The tail and tailfin of a fish are special adaptive structures for swimming. The tadpole too has a fish-like tail and tail fin which enables it to swim. iii Gills are gaseous exchange organs that are adapted for an aquatic environment. They are found in both fishes and tadpoles.		
Step 3 kinds of birds the third group representative. The third tutor.	The tutor lists the kinds of birds with the aid of a diagram as: carnivorous birds, grain eating birds, filter-feeding birds, insect eater's birds; nectar sucking birds, fish eaters, and seed eaters.	They listens to the tutor and draws the diagrams	Use of examples.

Step 4 Explanations of adaptive structure found in birds. The fourth tutor.	The tutor went ahead to state the explanations as; 1) Carnivorous birds such as eagles have powerful sharp, curved beaks for killing and tearing the flesh of their prey which include small birds, toads and lizards. i. They have sharp, strong, curved claws for catching gripping and killing the prey. ii. Grain eating birds like domestic fowls have short honey beaks for pecking at the grains. They also poses short, blunt and strong claws on their toes for scratching the soil. iii. The filter- feeding birds such as the water duck have beaks with serrated edges for sieving out food from water into the mouth. They also have webbed feet for swimming in the water. iv. Insect eaters, such as the wood peckers have long, slender, pointed beaks for picking insects from cracks and holes in the barks of trees. v. Nectar – sucking birds, such as humming bird and sunbird, have long hollow beaks with tubular tongues for sucking	They observe the teacher	Use of examples.
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	nectar from flowers. vi. Fish eaters, such as the king fish and heron, have long pointed beaks for killing and picking fish from the water and long feet for wading in the water. vii. Seed eaters such as parrots have strong, short and holed beaks for cracking hard seeds. Weaver birds on the other hand have short, strong and conical beaks for picking up small seeds.		
Step 5 Diagrams of adaptive structures found in bird's beaks and feet. The fifth peer tutor		They observe the teachers diagrams and draws their own	Use of examples.
Step 6 Evaluation. The sixth peer tutor evaluates the students.	The tutor evaluates the students with the following questions - List the kinds of birds and their feeding modifications. - Describe their adaptive structures found in above - Draw at least three adaptive structures found in their feats and fishes to life in water	They answers the tutors questions and ask their own.	Questioning

Conclusion/closure	The tutor summarizes the lesson of the day by highlighting some of the major points of the lesson and gives them a take home assignment.		
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NOTE OF LESSON FOR CONTROL GROUP

LESSON ON PEER TUTORING USING (RPT)

LESSON THREE

Class: SS11

Subject: Biology

Topic: Pollution (pollution of the atmosphere air pollution)

Duration: 45 minutes

Age: 5+

Previous knowledge: The teacher should enquire what the tutees know about pollution.

Instructional materials: Diagrams, lesson notes, chalk, board

Specific Objectives: At the end of the lesson, the tutees should be able to.

1. Define pollution
2. Describe air pollution and their nature.
3. List air pollutants and their sources.
4. Explain at least three effects and control of air pollution
5. List at least three sources and effects of noise pollution
6. Explain at least two control of noise pollution.

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITIES	TUTEES ACTIVITIES	STRATEGY
Step 1 Definition of pollution. The first peer tutor.	The tutor defines Pollution as the release of toxic or harmful substances into the environment by their natural forces or man and other animals to an extent that causes biological damage to man	They pay attention to the tutor and jot down points.	Explanations, Use of examples

	and his resources. Those things that causes pollutions are called pollutants.		
Step 2 Description of air pollution and their nature. The second tutor.	The second tutor describes air pollution as the introduction or release of harmful substances into the atmosphere. It can be in solid, liquid and gaseous forms.	They nodes their heads and jots down points.	Explanation.
Step 3. Air pollutants and sources. The third tutor.	Air pollutant includes the following such as carbon monoxide, nitrogen oxide, dust particles, soothes and smoke, radio-active rays. Sources: burning of full in cars, coal mining and cement industries, electrical discharge in air.	They pays attention to the tutor and jots down points.	Use of examples.
Step 4. Effects and control of air pollution. The fourth peer tutor	The effects of air pollution are as follows: i. it causes impaired health as the irritation of eyes, lungs and skin. ii It causes acid rain . iii. Dust particles reduce visibility .iv .Sooth can cover the leaves of plants thereby reducing photosynthesis. v. Nitrogen oxide can form nitric acid with water in air to form acid rain which corrodes metallic objects. Control: i Chemical waste should be discharged into the air through	They jots down points	Questioning, explanations.

	fume chambers. ii.Legislation should be made against indiscriminate burning that may bring about smoke . iii.Industries should be sited far away from residential buildings. iv.Conditions must be cheated for complete combustion of fuel in internal combustion engines.		
Step 5. Sources and effect of noise pollution. The fifth peer tutor.	The tutor also explains to the tutees that noise pollutant includes factories or industrial noise, Aeroplane or aviation noise, railway engine or locomotive noise, car horns and sirens, high pitched musical sound from loud speakers. Effects: It causes loss of hearing or deafness. iii) It causes general irritation or short temperateness. iv) It can cause changes in behavior.		Use of examples.
Step 6. Control of Noise pollution. The sixth peer tutor.	The control measures includes: i. Legislation should be made against the use of loud speakers, ii. There should be reduction of noise from loud speakers and car sirens.	They pays attention to the tutor and ask questions.	Explanations.

	iii. Ban on the use of heavy guns vi. Railways and air ports should be sited far away from residential areas.		
Step 7. Evaluation. The first tutor comes back to the stage to evaluate.	The tutor evaluates the tutees by asking them the following questions; 1. Define pollution 2. Describe air pollution and their nature 3. List air pollutants and sources 4. Explain at least three effects and control of air pollution 5 list at least three sources and effects of noise pollution. 6. Explain at least two controls of noise pollution.	They answers the tutors questions and ask theirs.	Questioning
Summary closure	The tutor summarizes the lesson by recasting the major factors in the lesson with the help of the teacher and gives assignment.		

NOTE OF LESSON FOR CONTROL GROUP

LESSON PLAN ON PEER TUTORING USING (RPT)

LESSON FOUR

CLASS: SS II

Subject: Biology

Topic: Pollution (water and soil Pollution).

Duration: 45 minutes

Precious knowledge: tutees have learnt air and noise pollutions.

Instructional materials: Diagrams, chalk, lesson notes and chalk board

Specific objectives: At the end of the lesson, tutees should be able to:

1. Describe land pollution
2. State at least three pollutants and sources of land pollution
3. Describe at least two effects and control of soil pollution
4. List at least three sources and pollutants of water pollution
5. Describe at least three effects and control of water pollution

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITIES	TUTEES ACTIVITIES	STRATEGY
Step 1 Introduction. The first tutor.	The tutor asks the students how does a polluted water looks like. With the tutees responses he/she introduces the lesson as water and soil pollution and writes it on the board.	The answered smells, change in color etc.	Set induction, use of examples
Step 2 Description of land pollution. The second tutor.	The second tutor describes land pollution as the contamination of water bodies, usually as a result of human activities. Water bodies includes lakes, rivers, oceans etc.	They nod their heads while listening to the teacher.	Explanations.

Step 3 Pollutants and sources of land pollution. The third tutor.	Land pollutants includes, refuse, sewage, metal scraps, chemicals, oil spillage. Sources: from homes, offices, abandoned vehicles and machines, oil drillings, markets etc.		Use of examples.
Step 4 Effects and control of land pollution. The fourth tutor.	The tutor went further to itemize the effects as: i) It causes offensive odor when the refuse decay. ii) Sewage can cause respiratory disorder. iii) This can cause breeding ground for diseases iv) Excess fertilizers can cause soil acidity and can cause the death of aquatic organisms. v) Metals occupy land spaces. Control: i) Refuse should be burnt in incinerators. ii) Urban waste should be properly burnt or buried iii) Legislation should be made by governments. iv) Metal soaps, tins, bottles, motor vehicles parts should be recycled.	They pays attention to the tutor and ask questions.	Explanation.
Step 5 pollutants and sources of water pollution. The fifth tutor.	The pollutants of water include; sewage, pesticides and fertilizers, chemical waste, excreta or feces, oil spillage. Sources: This includes city sewage systems, industries and ships at harbors, human and animals, oil drilling etc.	The tutor ask questions.	Use of examples

Step 6 Effects and control of water pollution. The sixth tutor	The tutor went further to explain the effects as; i. it makes water unfit for human consumption ii. It supports the growth of pathogens that can cause diseases e.g. cholera. iii. The can kill aquatic organisms iv. They produce unpleasant odors. Control: i) There should be efficient techniques to deal with or prevent oil spillage ii) There should be efficient and proper sewage disposal system. iii) Industrial effluents should be recycled. iv) Government or local authorities should strictly monitor all industrial wastes.		Explanations.
Step 7 Evaluation. The first tutor comes back to the stage	The tutor evaluates the tutees with the following questions i) Describe land pollution ii) State at least three pollutant and sources of land pollution . iii) Describe at least two effects and control of soil pollution iv) List at least three sources and pollutants of water pollution v) Describe at least there effects and controls of water pollution. The tutor summarizes the lesson with the help of the teacher by highlighting the major points on the topic and gives the tutees	They answers the tutor's questions and ask their own.	Questioning

	assignment.		
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NOTE OF LESSON FOR THE CONTROL GROUP

LESSON PLAN ON PEER TUTORING USING (RPT)

LESSONFIVE

CLASS: SS II

Subject: Biology

Topic: Association (types of association).

Duration: 45 minutes

Previous knowledge; the tutor should enquire what the student-peers knows about association.

Age: 15+

Instructional Materials: Diagrams, chalk, lesson notes, and chalkboard.

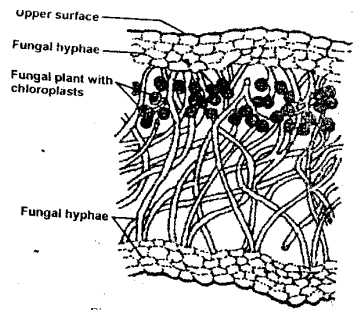
Specific objectives: At the end of the lesson, the tutees should be able to.

- 1) Define association
- 2) List the types of associations
- 3) Explain at least one type of association with an example listed above.
- 4) Draw a diagram to illustrate symbiotic association

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITIES	TUTEES ACTIVITIES	STRATEGY
Step 1 Introduction. The first tutor.	The first tutor introduces the lesson by asking the tutees to explain how they relate with one another, with their responses, he/she introduces the lesson and writes it on the board as association.	They answered by giving, receiving	Set induction use of examples
Step 2	The second tutor explains	They pay	Use of

Definition of association. The second peer tutor.	association as a group of organisms (plants and animals) that live together in a certain geographical region and constitute a community with a few dominant species.	attention to the tutor and jot down points	examples.
Step 3 Types of association. The third peer tutor	The third tutor explains to the tutees that there are five main types of associations namely, symbiosis, commensalism, parasitism, predation and competition.	They ask the tutee questions.	Explanations.

Step 4 explanations of the types of association. The fourth peer tutor.	i) Symbiosis is a close association between two organisms on which both of them benefit from each other. Each member is called symbiont. Examples i) Alga and fungus in lichen, ii) Protozoa in the intestine of termites iii) Bacteria in the rumen of ruminants. 2) Commensalism: This is an association between two organisms living together in which only one (commensal) benefits from the association while the other is neither benefited nor harmed. Examples i) Remora fish and shark ii) Oyster and crab. iii) Man and intestinal bacteria. 3) Parasitism: This is a close association between two organisms in which one, known as the parasite lives in or on and feeds at the expense of the other organism which is known as the cost example i. Man and the tapeworm, mistletoe and flowering plant. 4. Parasitic association is the type that exist between two organisms in	They observed the teacher.	explanations
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	which the predation kills the other called the prey. Examples: The hawk and drinks of domestic fowls ii. The lion and goat. 5. Competition: This involves the interactions among two organisms of the same or different species which one outgrows the other and survives while the other can neither grow nor survive. When competition is between members of the same species it is called intra specific competition while it is called inter- specific competition of it is between members of different species.		
Step 5 Diagram of symbiotic association. The fifth peer tutor.		They observe the teachers diagram and draws their own.	Use of examples.

Step 6 Evaluation. The sixth tutor.	The tutor evaluates the tutees with the following questions i. Define association ii. List the types of association iii. Explain at least one type of association with example. iv. Draw a diagram to illustrate symbiotic association Conclusion/closure. They summarized the lesson by giving them assignment.	They answers the tutors' questions and ask theirs if they have any.	Questioning
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NOTE OF LESSON FOR CONTROL GROUP

LESSON PLAN ON PEER TUTORING USING (RPT)

LESSON SIX

CLASS: SSII

Subject: Biology

Topic: Association (features of biological importance possessed by organisms of an association)

Duration: 45 minutes

Previous knowledge: The tutees have learnt types of association

Specific objectives: At the end of the lesson tutees should be able to:

- i List two features of biological importance's possessed by organisms in symbiotic association.
- ii State two features of biological importance possessed by organisms in commensalism association
- iii List one feature of biological importance possessed by organisms in parasitic association.
- iv State two features possessed by organisms in predation association.

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITIES	TUTEES ACTIVITIES	STRATEGY
Step 1 introduction. The first tutor.	The tutor introduces the lesson by asking if they have seen a lichen before, with their responses he/she introduces the lesson as features of biological importance possessed by living organisms.	They responded yes, no.	Set induction, use of examples, explanation.
Step 2 features of biological importance possessed by organisms in symbiotic	The second tutor describes lichen with the aid of a diagram as the combination of fungus and algae living together. It is a mutual relationship. Here the biological importance is that algae has green pigments (chloroplast) which helps to synthesize food while the	They observe the tutors diagram and draws theirs.	Use of examples.

association (lichen). The second tutor.	fungus has hyphae which helps to absorb nutrient there by encloses and protects the algae from physical damage.		
Step 3.Features of biological importance in commensalism association (oyster and crab). The third tutor	The third tutor describes it by saying that in commensalism association, only one organism benefits while the other is neither harmful nor beneficial. A case study of oyster and crab. The oyster has shell and gills which serves as a habitat for the crab: while it is not gaining or losing anything from the crab.	They listens to the tutor and jots down points.	Explanations.
Step 4.Biological features in parasitic association. The fourth tutor.	A case study of mistletoe and flowering plants. The fourth tutor went further to explain that mistletoe has haustorium through which they extract water and nutrient from the host plant.	They ask questions.	Use of examples.
Step 5.Competitive association. The fifth tutor	The fifth tutor describes with the help of the diagram on the chart. An example is the hawk and chicks the hawk is bigger than chicks with sharp beaks and toe used for capturing and tearing the chicks.	They observed the diagram and ask questions.	Use of examples.
Step 6.Evaluation. The first tutor comes back the stage to evaluate the students.	The tutor evaluates the tutees with by asking them the following questions i. List two features of biological importance possessed by organisms in symbiotic association. ii. State two features of biological importance possessed by organisms in commensalism association iii. List one biological features of biological importance possessed by organisms in parasitic association. iv. State two biological importance possessed by organisms in predation association. The tutor emphasized on the major	They answers the tutor's questions and ask theirs if they have any.	Questioning.

	points with the help of the teacher and gives the tutors a take home assignment.		
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NOTE OF LESSON FOR CONTROL GROUP

LESSON PLAN ON PEER TUTORING USING (RPT)

LESSON SEVEN

Class: SS II

Subject: Biology

Topic: Conservation of natural resources

Age 15+

Duration: 45 Munities

Previous knowledge: The tutor should enquire from the students what they know about conservation of natural resources.

Instructional materials: Diagrams, chalk, lesson notes and chalk board

Specific objectives: At the end of the lesson, the tutees should be able to:

1. Define the term conservation of natural resources
2. State the two types of conservation of natural resources.
3. List and explain at least four ways of ensuring conservation of natural resources

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITIES	TUTEES ACTIVITIES	STRATGY
Step 1 Definition of conservation of natural resources. The first tutor.	Conservation of natural resources is the prevention of natural resources from loss, waste or exploitation through rational use and to ensure their continued use or availability and preserve the quality or original nature of natural resources.	They pays attention to the tutor and jots down points.	Explanations.

Step 2 Types of conservation of natural resource. The second tutor.	The tutor explains as ;i) Renewable natural resources as the ones that are renewable e.g. rain, animals, plants, water, air etc. ii) Non- renewable as the ones which when exhausted cannot be replaced or recovered e.g. petroleum, coal, tin, copper etc.	They nodes their heads and ask questions.	Use of examples.
Step 3 Ways of ensuring conservation of natural resources. The third tutor.	The tutor starts by listing them as: 1)Establishment of agencies for conservation: Agencies are established to ensure that these natural resources are conserved examples of those agencies are i Forest departments. ii Ministries of agriculture iii) Nigerian conservation foundation. 2) Establishment of game reserves or national parks. The game reserve serves for promotion of wildlife, rare or endangered species and for recreational purposes as well as scientific purposes. E.g. Borgu game reserve in Niger State. 3) Conservation education: This serves to inform the populace about the need to conserve natural resources and the consequences of examination or exhaustion of such resources like trees, wild life and minerals.	They jots down points	explanations

	4. Making conservation laws, edicts or decrees: They are made by government to regulate the feeling of trees, hunting of endangered species or indiscriminate exploitation of mineral resources. 5. Setting standards for pollution control: These protect land, water and air resources from certain level of pollutions from industries, vehicles, power plants and homes.		
Step 4 Evaluation. The fourth tutor.	The tutor evaluates the tutees with the following questions. i) Define the term conservation of natural resources. ii) State the two types of conservation of natural resources iii) List and explain at least four ways of ensuring conservation of natural resources.	Answers the teachers' questions and ask theirs.	Questioning
Conclusion/Summary	The tutor summarizes the lesson with the help of the teacher by highlighting some of the major points of the lesson and gives them assignment.	They answers the tutors' questions.	

NOTE OF LESSON FOR CONTROL GROUP

LESSON PLAN ON PEER TUTORING USING (RPT)

LESSON EIGHT

Class: SS II

Subject: Biology

Topic: Benefits of conservation of natural resources

Duration: 45 minutes

Age: 15+

Previous knowledge: tutors have learnt conservation of natural resources.

Instructional materials: Diagrams, chalk, lesson notes, and chalk board.

Specific objectives: At the end of the lesson, tutors should be able to:

1. State at least three benefits of wildlife conservation
2. State at least three benefits of water resource conservation
3. List at least four benefits of forest resources conservation
4. Enumerate at least three benefits of social resources conservation.
5. State at least two benefits of Air resource conversation

CONTENT DEVELOPMENT	PEER TUTORS ACTIVITIES	TUTEES ACTIVITIES	STRATEGY
Step 1 Introduction. The first tutor.	The tutor asks the tutees if natural resources are useful to us? With their responses, he/she introduces the lesson as benefits of natural resources.	Yes	Set induction, use of example

Step 2 Benefits of wild life conservation	The tutor lists them out as; i) It provides food for human consumption, e.g. meat, fish ii) It generates revenue for government. iii) it can serve as tourist centers for pleasure and relaxation iv) It provides research work for scientist. v) It can generate employment for some people.	They pays ttention to the tutor	Use of examples.
Step 3 Benefits of water resources conservation. The second tutor.	- i It serves as sources of food supply, e.g fish, prawns, and crayfish. - ii It serves as medium for transportation in rivers, lakes. - iii It provides employment for people e.g fishermen, canoe or ship builders. - iv It is useful for domestic and industrial uses e.g. dinking, washing, cooking etc. v. it is used for hydroelectric power generation which provides electricity e.g. kanji dam.		
Step 4 Benefits of forest resource conservation. The fourth	i) It serves as wind break. ii) They are homes or habitats of wild animals which can serve as game reserves.	They jots down points.	Use of examples.

tutor.	iii) It provides medicinal herbs iv) It is the sources of timber for construction purposes v) They are sources of (fuel) fire wood used for cooking.		
Step 5 Benefits of soil resources conservation.	The tutor lists them out as: i) Soil supports agricultural or farming activities. ii) Building are erected on the soil iii) It is the home for some organisms iv) Soil supports wildlife resources. v) Soil also supports forest and its resources. vi) Mineral resources are obtained from the soil.		
Step 6 Benefits of air resource conservation. The sixth tutor.	i) Air provides oxygen used in respiration by plants and animals. ii) It is habitat for some organisms e.g. birds, insects iii) Provides gaseous nitrogen used by plant to manufacture proteins. iv) It provides carbon dioxide used by plants for photosynthesis.	They listens to the teacher.	Questioning.

Step 7 Evaluation. The first peer tutor comes back he stage to evaluate the tutees.	The tutor evaluates the students with the following questions: i) State at three benefits of wild life conservation ii) State three benefits of water conservation iii) Sate four benefits of forest resource conservation. iv) Enumerate three benefits of soil resource conservation v) State two benefits of air resources conservation	They answers the tutor's questions, ask theirs and jots down points.	Questioning.
Conclusion/closure	The tutor, with the help of the teacher, summarizes the lesson of the day by highlighting some of the major points of the lesson and gives assignment to the tutees.		

APPENDIX L
EXPERTS COMMENTS ON INSTRUMENT

APPENDIX L

Result Output

RESEARCH QUESTION ONE

Group Statistics

	Method	N	Mean	Std. Deviation	Std. Error Mean
Pretest	RPT	90	32.57	9.283	.979
	CWPT	90	33.17	7.797	.822
Posttest	RPT	90	51.24	5.498	.580
	CWPT	90	55.66	5.389	.568

HYPOTHESIS ONE

[DataSet1]

Between-Subjects Factors

		Value Label	N
Gender	1	Male	88
	2	Female	92
Method	1	RPT	90
	2	CWT	90

Tests of Between-Subjects Effects

Dependent Variable: Posttest

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1084.969 ^a	4	271.242	9.371	.000
Intercept	33722.582	1	33722.582	1165.010	.000
Pretest	15.602	1	15.602	.539	.464
Gender	159.495	1	159.495	5.510	.020
Method	922.083	1	922.083	31.855	.000
Gender * Method	34.196	1	34.196	1.181	.279
Error	5065.581	175	28.946		
Total	520393.000	180			
Corrected Total	6150.550	179			

a. R Squared = .176 (Adjusted R Squared = .158)

RESEARCH QUESTION TWO

[DataSet1]

Group Statistics

	Method	N	Mean	Std. Deviation	Std. Error Mean
pretest	RPT	90	2.693750	.3911604	.0412319
	CWPT	90	2.656250	.3615629	.0381121
Posttest	RPT	90	2.971528	.3927406	.0413985
	CWPT	90	3.510417	.3349715	.0353091

HYPOTHESIS TWO

Between-Subjects Factors

		Value Label	N
Gender	1	Male	88
	2	female	92
Method	1	RPT	90
	2	CWT	90

Interest

Dependent Variable: Posttest

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	14.140 ^a	4	3.535	27.323	.000
Intercept	32.798	1	32.798	253.496	.000
Pretest	.035	1	.035	.274	.601
Gender	.368	1	.368	2.846	.093
Method	13.395	1	13.395	103.527	.000
Gender * Method	.726	1	.726	5.610	.019
Error	22.642	175	.129		
Total	1927.484	180			
Corrected Total	36.782	179			

a. R Squared = .384 (Adjusted R Squared = .370)

RESEARCH QUESTION THREE

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Male	88	32.64	9.135	.974
	Female	92	33.09	8.002	.834
Posttest	Male	88	54.32	5.277	.563
	female	92	52.62	6.288	.656

RESEARCH QUESTION FOUR

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Male	88	2.632102	.3848598	.0410262
	female	92	2.716033	.3648363	.0380368
Posttest	Male	88	3.273438	.5197528	.0554058
	female	92	3.209918	.3793907	.0395542

RESEARCH QUESTION FIVE

[DataSet2]

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
PretestExp	Male	42	33.40	7.799	1.203
	Female	48	32.96	7.871	1.136
PosttestEXP	Male	42	57.12	5.260	.812
	Female	48	54.38	5.221	.754

[DataSet2]

Group Statistics

	gendercontrol	N	Mean	Std. Deviation	Std. Error Mean
pretestC	Male	46	31.93	10.240	1.510
	Female	44	33.23	8.232	1.241
posttestC	Male	46	51.76	3.825	.564
	Female	44	50.70	6.832	1.030

RESEARCH QUESTION SIX

[DataSet2]

Group Statistics

	Gendercontrol	N	Mean	Std. Deviation	Std. Error Mean
Preinterest	Male	46	2.716033	.4436486	.0654124
	Female	44	2.670455	.3310933	.0499142
postinterest	Male	46	2.953804	.4055678	.0597977
	female	44	2.990057	.3826599	.0576882

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Male	42	2.540179	.2858521	.0441079
	Female	48	2.757813	.3920387	.0565859
Posttest	Male	42	3.623512	.3905535	.0602637
	Female	48	3.411458	.2407992	.0347564