EFFECTS OF PEER TUTORING INSTRUCTIONAL APPROACHES ON TECHNICAL COLLEGE STUDENTS' ACHIEVEMENT, INTEREST AND RETENTION IN BASIC ELECTRICITY IN GOMBE STATE, NIGERIA

BY

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MARCH, 2023

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS DEGREE IN INDUSTRIAL AND TECHNOLOGY EDUCATION, ELECTRICAL ELECTRONICS TECHNOLOGY EDUCATION

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ABSTRACT

The study investigated the effects of peer tutoring (Bidirectional and Unidirectional) instructional approaches on technical college students' achievement, interest and retention in basic electricity in Gombe State. Six research questions and six null hypotheses guided the study. The study adopted pre-test post-test non-equivalent control group design of quasi-experimental study. The study was conducted in six Technical Colleges in Gombe State. A purposive sampling technique was used to drawn four technical colleges for the study. A total of 194 NTC I comprised of 146 males and 48 females students from four technical colleges was used as a sampled population for the study. Simple balloting technique was used to assigned two schools to experimental group one and the other two schools to experimental group two. The instruments used for data collection were: Basic Electricity Achievement and Retention Tests (BEART) and Basic Electricity Interest Inventory (BEII). The BEART and BEII were subjected to face and content validation by three experts. The reliability coefficient of BEART was found to be 0.79 through Kuder-Richardson 21 (K-R 21), while that of BEII was 0.83 through Cronbach Alpha Statistics. Mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05level of significance. The findings of the study revealed among others that: both Bidirectional and Unidirectional peer tutoring instructional approaches significantly enhanced students' academic achievement and retention as well as aroused students' interest in Basic Electricity. The finding further revealed that the students taught Basic electricity using BPT instructional approach had higher mean achievement scores (30.84 > 30.64) than those taught with UPT instructional approach. Also the students taught Basic electricity using BPT instructional approach had higher mean interest scores (35.47 > 32.81) than those taught with UPT instructional approach. Similarly, the students taught Basic electricity using BPT instructional approach had higher mean retention scores (27.94 > 27.82) than those taught with UPT instructional approach. The result of the hypotheses tested showed that, there was no significant difference in the mean achievement and retention, but there was a significant difference in the mean interest scores of learners in both instructional approaches. The results of the hypotheses tested further revealed that there was no significant influence between gender on students' academic achievement and retention as well as students' interest in Basic Electricity when taught using bidirectional and unidirectional peer tutoring instructional approaches. Based on the findings, it was recommended that: teachers should adopt peer tutoring instructional approaches in the teaching and learning as this would enhance students' academic achievement and retention as well as students' interest in Basic Electricity.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Technical colleges are training institutions for producing young manpower for a country's economic growth and development. Technical colleges are established According to the National Policy on Education (NPE) to train and produce craftsmen and master craftsmen Federal Republic of Nigeria (FRN, 2014). The trades offered at the technical colleges include; Motor Vehicle Mechanics, Block lying, Bricklaying, and concreting, Welding and Fabrication, Furniture making and upholstery, and Electrical installations and maintenance works among others. These lead to the award of different levels of certificates. The certificates awarded in technical colleges are National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC), According to the National Board for Technical Education (NBTE) (2013) technical colleges in Nigeria are established to prepare individuals to acquire practical skills and basic scientific knowledge. Upon graduation, technical college students are expected to secure employment, set up their own business to be self-reliant, or further their studies (FRN, 2014). However, one of the trade-related subjects necessary for those categories of students in electrical installation and maintenance work is Basic Electricity.

Basic electricity is one of the fundamental subjects offered in electrical installation and maintenance practice, Radio and Television, and Electronics trades. The subject deals with all the fundamental issues of Current-electricity, Static-electricity, and electronics as studied in schools and colleges. The objectives of Basic electricity as contained in the NBTE (2013) syllabus include: the ability of the students to be able to demonstrate an understanding of the Structure of matter and its relevance to electricity, chemical sources of electromotive force, resistors, capacitors and inductors, values and functions of

resistors, the values of resistor (s), ohm's law and its application, Distinguish between AC and DC quantities, principles of transformers, its construction and operation, simple electrical circuits, electronic sign and symbols and indicating instruments. The knowledge of Basic electricity plays a significant role in enhancing the country's social, industrial, and economical system. Robinson (2018) explained that basic electricity is the bedrock of all technological subjects, and also the key to the industrial development of any nation, since industries cannot function without electricity. Nevertheless, with all the efforts put in place by the teachers in imparting the required knowledge and skills to the technical college students over the years, their academic achievement has consistently remained unimpressive in Nigeria and Gombe State in particular. This low achievement in the words of Umoru and Onoja (2017) could be attributed to poor instructional delivery approaches adopted by teachers.

Poor instructional approaches could lead to a lack of interest on the part of the learners. Hence, it is a source of concern for researchers. Researchers have identified defective teaching methods as one of the reasons for the poor performance of students in Basic electricity in the NABTEB examination (Atsumbe *et al*., 2019). It is evident from the above that students' academic achievement in basic electricity can improve if teachers change their teaching approach to more innovative and effective teaching strategies (Zakaria *et al.,* 2015). Therefore, student-centred teaching methods could improve students' academic achievement in different subjects better than teacher-centred methods. But teacher-centred method of teaching has its own usefulness but may not be an effective instructional method for improving students' achievement in skill-based subjects because students' involvement in teaching and learning process is low, and this makes students rely on their teachers for their learning needs (Nwaukwa & Okolocha, 2020). For these reasons, therefore, Idris (2019) stressed that these challenges necessitate a shift from

conventional teaching methods to constructivist instructional approaches. Such social constructivist instructional approaches include collaborative learning, cognitive apprenticeship, case-based instruction, problem-solving, and peer-tutoring.

Peer-tutoring is a viable instructional approach that offers students in heterogeneous classroom opportunities to partner within themselves, by linking high achieving students with low achieving students or those with comparable achievement. Igbo (2018) defined Peer-tutoring as a teaching process whereby a student who has proficiency in a skill teaches another student under the teacher's supervision. It is a process of chain teaching whereby the teacher shows a student how to perform a skill and the student, in turn, trains a second student on the same or similar skill. Cockerill *et al.* (2018) also stressed that Peer-tutoring is an active teaching methodology that fosters student inclusion while enabling students to learn from each other. These interactions between tutors and tutees promote active learning and foster student inclusion, as all students participate in the process (Fung *et al.,* 2018). During Peer-tutoring, there is free and friendly atmosphere within the students that naturally eliminate fear of criticism, thereby facilitating learning within and outside the purview of the contents of instruction. Igbo (2018) classified Peer tutoring instructional approaches as: Class-wide peer tutoring, Cross-age peer tutoring, Reciprocal peer tutoring, Bidirectional and Unidirectional Peer Tutoring. However, this study will cover Bidirectional and Unidirectional peer-tutoring instructional approaches.

Bidirectional Peer Tutoring (BPT) is a type of peer tutoring which involves students teaching other students, preferably pairing a high-performing student with those with low performance. Each student in the pair monitors and evaluates the other, which provides a sense of equal status among participants. Cervantes *et al.* (2018) pointed out that BPT is an innovative way to maximize classroom resources and provide a more effective and

dynamic experience for all students. It is a technique that breaks the entire class into pairs or small groups of four to six students. As the tutee performs each task, the tutor provides feedback and records the number of performances. Each student in the pair or group is involved in the reciprocal roles of tutor and tutee. This approach provides a way for all students to partner with one another. Costantini (2015) mentioned that BPT is an effective intervention for the improvement of content knowledge, and increased understanding of subject matter. By extension increases students' achievements, interest and retention of learning. Hence, another constructivist instructional approach that is student-centred is called Unidirectional Peer Tutoring

Unidirectional Peer Tutoring (UPT) is another type of peer tutoring instructional approach whereby students who are more advanced in a specific skill serve as tutor for students who need special assistance in learning identified concepts, applications and skills. The UPT which is referred to as One-on-One peer tutoring occurs when only one student is trained to serve as a peer tutor to low-performing students. The UPT is characterized by specific role-taking and a high focus on curriculum content (Topping *et al.*, 2017). The process in a study conducted by Topping and others used the following procedures as identification of learning task; analysis of learning task; presentation of the learning task to the whole class by the teachers; selection of peer tutors; briefing assigning tasks to the tutors; the pairing of tutor with tutees; discussion of tutors with tutees; monitoring of peer activities throughout the activity and provision of clue; teacher processes feedback for incorrect responses and praises for correct answers and appropriate cooperation; teachers guide and conclusion (Topping *et al.,* 2017). In this approach, the tutor waits for tutees to attempt a problem independently before offering assistance, encouragement and correct responses. In this approach, students are provided with the opportunity to partner with one another and promote understanding that may improve their academic achievement.

Achievement is regarded as the outcome of an action that is completed by hard work. Academic achievement of a student represents performance outcomes of student which include the knowledge, skills and ideas acquired and retained through his course of study, specifically in school, college, and university. Odeh *et al.* (2018) referred to student achievement as the scores students have attained in either test or examination which determine their performance. Academic achievement also denotes the knowledge attained in the school subject which is usually designed by a test score (Yeung, 2015). Academic achievement refers to a person's strong performance in a given academic arena. A student who earns good grades or awards in exams has achieved in the academic field. Saka-Alikinla *et al.* (2019) maintained that academic achievement test is often constructed and standardized with the view to measure proficiency of learners in different subjects. The academic achievement of students in basic electricity indicates the performance of students in basic electricity as represented by scores or marks on an achievement test. Hence, the use of appropriate instructional approaches in teaching Basic electricity subjects, will enhance student achievement. While poor instructional delivery approaches will lead to retardation of learners' interest.

Interest is an important variable in learning because when one becomes interested in an activity, one is likely to be more deeply involved in that activity. Interest is a powerful motivational process that energizes learning, and is essential to academic success. Ige, *et al.* (2017) defined interest as a social construct developing within the dynamic relationship between the individual and the situation. Ugwanyi (2018) pointed out that the type of interest a student brings into the classroom is an important factor for his/her achievement or otherwise in a subject. This implied that, if students have a positive interest in Basic electricity they will not only enjoy studying it but would also drive satisfaction from the knowledge and skills acquired therein. Interest is a tendency to

become absorbed in an experience and to continue in it. It is the zeal or willingness to participate in an activity from which one derives some pleasure. Interest is therefore a necessary ingredient before learning can take place; for a child is bound to pay attention as a lesson goes on if such a child is interested in the particular subject. Relating it to this study, interest is the motivation of students to like basic electricity through the use of BPT and UPT in the teaching and learning process. One is likely to do well in a discipline of interest. The low achievement in Basic electricity may be a sign of lack of interest by students. Ogbuanya and Owodunni (2016) observed that the high failure rate of students in technical college has been attributed to a lack of interest. Interest in learning a concept by students helps in the retention of knowledge and skills.

Retention has to do with the ability to remember and apply previously learned behaviour. Retention is the capacity to prompt performance and embrace such performance for periods of time (Atsumbe *et al*., 2019). The authors stressed that retention is the rate at which students perform in a subject's area in terms of skills and knowledge acquired over time. Miller (2014) sees retention as the learning that lasts beyond the initial unit of a lesson and is assessed with test administration two or more weeks after the information has been taught and tested. Retention in the context of this study means the ability of Basic electricity students to repeat an acquired concept, knowledge, skill and attitude in Basic electricity over time with less error either through their responses to test administered on them or practical application of the acquired competency. Basic Electricity as one of the engineering trades offered in technical colleges, is designed to provide the trainees with basic knowledge and practical skills in electrical electronics technology. Being the only module that cuts across the entire engineering and related technical subjects, it ought to be taught well to ensure that students acquire the necessary knowledge and practical skills for employment after graduation irrespective of gender.

Gender refers to psychological terms, that describe behaviours and attributes expected of an individual based on being a male or a female. Gender according to Nduji and Madu, (2020) is a social or cultural construct, attribute and roles being given by the society and it varies from place to place or culture to culture. Gender is also one of the factors that influence students' academic achievement in Basic electricity at Technical colleges. Studies have shown that gender has a significant influence on students' achievement. Researches have been conducted in the area of gender-related differences in the academic achievement of students in different areas. Some studies revealed that there is a significant difference between the mean achievement scores of male and female students (Amogne, 2015; Olasehinde & Olatoye 2018; Owodunni & Ogundola, 2018). While other studies such as (Hashim *et al.,* 2015; Lin, 2015) revealed that there was no significant difference between mean achievement scores of male and female students. Yet, another study showed a significant difference in favour of girls (Voyer & Voyer, 2014). Based on the variations in research findings by various researchers, the researcher aimed at determining the effects of peer tutoring instructional approaches on technical college student's achievement, interest and retention in Basic electricity in Gombe State.

1.2 Statement of the Research Problem

Basic electricity is a compulsory trade related subject offered by every students willing to take a future career in the field of electrical/ electronic trades or related fields. It is so disheartening to note that technical college graduates of electrical trades are finding it difficult to achieve the aims and objectives as stipulated in the National Policy on Education. Evidence from the literature of Atsumbe *et al.* (2019) revealed that there is a persistent low achievement of students in Basic Electricity in both internal and external examinations. For instance, the needed skills in all aspects of basic electricity according to the NABTEB chief examiners' report (2015) have been declining over the years. The

examination records on the performance of the student's in basic electricity in Gombe State, Nigeria from 2014 to 2019 as released by NABTEB revealed that in the 2014/2015 academic session, 173 students sat for the examination, 86 students passed with credit, which represents 50.34%, While 87 students failed, in 2015/2016, 205 students sat for the examination, 102 students scoring credit and above, which represents 50%, while 103 students failed, in 2016/2017, 194 students sat for the examination with 96 students scoring credit and above, which represents 50.34%, while 98 failed the examination, in 2017/2018, 192 students sat for the examination with 93 students scoring credit and above, which represents 43.83%, while 99 students failed, 47.62% in 2018/2019 Appendix C page 107.

These low achievements in basic electricity may be attributed to poor instructional delivery approaches adopted by teachers, students' interest, and teachers' laxity towards teaching, concentration on few topics for examination purposes, and students' inability to recall previously learned materials (Umoru & Onoja, 2017). This makes the realization of the goal for technical colleges in most states in the country including Gombe State to be far below expectation.

This has led many instructors/teachers into looking for alternative ways of improving teaching and learning of basic electricity. One way of improving teaching and learning of basic electricity is through the use of peer tutoring instructional approaches. The use of bidirectional peer tutoring and unidirectional peer tutoring has been purported to have the potential of improving learning in technical drawing (Adam, 2019). It is hoped that the use of bidirectional and unidirectional peer tutoring may also improve teaching and learning of basic electricity. The problem of this study, therefore, is put in a question form: What is the effects of bidirectional peer tutoring and unidirectional peer tutoring on

technical college students' achievement, interest and retention in basic electricity in Gombe State, Nigeria?

1.3 Aim and Objectives of the Study

The aim of the study is to determine the effects of bidirectional and unidirectional peer tutoring instructional approaches on technical college students' achievement, interest and retention in basic electricity in Gombe State, Nigeria. Specifically, the study determine the effects of:

1. Bidirectional and unidirectional peer tutoring instruction on the students' achievement in Basic electricity.
2. Bidirectional and unidirectional peer-tutoring instruction on students' interest in Basic electricity.
3. Bidirectional and unidirectional peer-tutoring instruction on students' learning retention in Basic electricity.
4. Gender on student's achievement when taught Basic electricity using bidirectional and unidirectional peer-tutoring instruction approach.
5. Gender on student's interest in Basic electricity when taught using bidirectional and unidirectional peer-tutoring instructional strategies.
6. Gender on student's learning retention in Basic electricity when taught using bidirectional and unidirectional peer-tutoring instructional strategies.

1.4 Significance of the Study

The findings of this study will be of benefit to Gombe State Science and Technology Schools Board, Gombe State Ministry of Education, electrical installation work teachers, electrical installation work students, Employers of Labour, NBTE, Curriculum planners and the society at large. The result of this study if found to improve on Technical College

Students' achievements, interest and retention, will be of help to Gombe State Science and Technical School's Board when published or online. The study could provide information on the teaching methods that are found to be more effective.

The Basic Electricity teachers will benefit from the findings of the study by using BPT and UPT lesson plans prepared by the researcher. If BPT and UPT are found to be effective in enhancing student's achievement, interest and retention, the teacher will find the result of the study very useful if published and accessed by them. It will assist teachers to prepare and adapt the method thereby shifting from a teacher-centred approach to student-centred environment that will lead to the acquisition of the needed skills in electrical and electronic industries. When the study is been published and found to be positive on technical college student's academic achievement, interest and retention on both genders, the National Board for Technical Education and Gombe State Ministry of Education will recommend for its adaption and organize workshops, seminars and capacity building for teachers of technical colleges. Hence, the teachers will be well equipped and prepared to adapt BPT and UPT instructional approaches in teaching students to meet the modern industrial demand.

The finding of this study will be of benefit to employers of labour, when electrical/electronic craftsmen are been employed. Because industries are in dear need of well-trained, skilled, creative and productive craftsmen who are ready to work efficiently and cooperate among colleagues. When students are been taught with effective and innovative teaching methods it will help produce quality skilled craftsmen that will meet the industrial demands, as well as save the cost of training and retraining of employees through organizing workshops and seminars.

The findings of this study will be beneficial to NBTE as the study could provide information on the relative effectiveness of the Bidirectional and Unidirectional peer-tutoring instructional approach that is found more effective or both if there is no difference. This may encourage NBTE, as it coordinates the activities of technical colleges, to insist on the provision of tools and equipment and necessary instructional materials that can facilitate the use of any of the instruction in teaching Basic electricity at the technical college level by organizing conferences, seminars, and workshops. The curriculum planners will also benefit from the findings because this will help to inculcate modern teaching methods that can meet modern industrial standards. For the employers of labour, the use of bidirectional peer- tutoring and unidirectional peer-tutoring in the classroom will be helpful in the production of quality manpower that meets the modern world. This will also save the cost of retraining through the organizing of workshops, seminars and conferences.

1.5 Scope of the Study

This study is on the effects of Bidirectional and Unidirectional peer tutoring instructional approaches on the academic achievement, interest and retention of students in basic electricity in Gombe State, technical colleges. Specifically, this study was delimited to the following aspects of basic electricity for National Technical Certificate I (NTC I) students as contained in NBTE Curriculum and NTC program. The aspects include: structure of matter and its relevance to electricity, chemical sources of electromotive force, resistors, capacitors and inductors, values and functions of resistors, the values of resistor (s), Ohm's law and its application, distinguish between AC and DC quantities, simple electrical circuits. Other contents such as principles of transformers, its construction and operation, electronic sign and symbols, and indicating instruments are

not covered, due to financial constraints and time factors. The study entails the use of Bidirectional and Unidirectional peer tutoring for lesson delivery.

1.6 Research Questions

The following research questions were answered in the study:

1. What is the effect of bidirectional and unidirectional peer tutoring instructional approaches on the students' achievement in Basic electricity?
2. What is the effect of bidirectional and unidirectional peer tutoring instructional approaches on the students' interest in Basic electricity?
3. What is the effect of bidirectional and unidirectional peer tutoring instructional approaches on the students' learning retention in Basic electricity?
4. What is the effect of gender on student achievement in Basic electricity when taught using bidirectional and unidirectional peer tutoring instructional approaches?
5. What is the effect of gender on students' interest in Basic electricity when taught using bidirectional and unidirectional peer tutoring instructional approaches?
6. What is the effect of gender on students learning retention in Basic electricity when taught using bidirectional and unidirectional peer tutoring instructional approaches?

1.7 Research Hypotheses

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

Ho_1: There is no significant difference between the mean achievement scores of students taught Basic electricity using bidirectional peer-tutoring instruction and those taught using unidirectional peer tutoring instructional approaches.

Ho_2: There is no significant difference between the mean interest scores of students taught Basic electricity using bidirectional peer-tutoring instruction and those taught using unidirectional peer tutoring instructional approaches.

Ho_3: There is no significant difference between the mean retention scores of students taught Basic electricity using bidirectional peer-tutoring instruction and those taught using unidirectional peer tutoring instructional approaches.

Ho_4: There is no significant difference between the mean achievement scores of male and female students taught Basic electricity using bidirectional peer-tutoring instructional approaches.

Ho_5: There is no significant difference between the mean interest scores of students taught Basic electricity using bidirectional peer-tutoring instructional approaches.

Ho_6: There is no significant difference between the mean retention scores of male and female students taught Basic electricity using bidirectional peer-tutoring instructional approaches.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Social Cognitive Theory (SCT)

The Social Cognitive Theory (SCT) was propounded by Bandura in 1977. The Social-Cognitive Theory is a theory used in psychology, education, communication and technology; it holds that portions of an individual's knowledge acquisition can be directly related to observing others within the context of social interactions, experiences, and outside media influences.

The SCT believed that when people observe a model performing behaviour and the consequences of that behaviour, they remember the sequence of events and use this information to guide subsequent behaviours. Observing a model can also prompt the viewer to engage in behaviour they already learned. In other words, people do not learn new behaviours solely by trying them and either succeeding or failing, but rather, the survival of humanity is dependent upon the replication of the actions of others. Depending on whether people are rewarded or punished for their behaviour and the outcome of the behaviour, the observer may choose to replicate behaviour modeled. SCT was referred to a psychological model of behaviour that emerged primarily from the work of Bandura (1977). Initially developed with an emphasis on the acquisition of social behaviours, SCT continues to emphasize that learning occurs in a social context and that much of what is learned is gained through observation. SCT has been applied broadly to such diverse areas of human functioning as a career choice, organizational behaviour, athletics, and mental and physical health. SCT also has been applied extensively by those interested in understanding classroom motivation, learning, and achievement. Bandura believed that humans can learn through observation without the need for imitation; learning could be

either direct or indirect (vicarious) in that one could learn through observing others' behaviours and the consequences of those behaviours. Bandura (1977) posit that, the strict stimulus/response theory of behaviorism focuses too much on the learner's actual behaviour. He proposes that learning happens when we take observed behaviour and assimilate it into our knowledge database.

Bandura proposed that the key factors that influence learning begin with the observation of others. Through observation of modeled behaviours, attitudes, emotional reactions, the learner makes decisions about how to act. However, this learning does not happen through a stimulus/response. Schun (2018) stated that Bandura's Social-Cognitive Theory is considered a theory that focuses on learning in a naturalistic setting. It is this type of informal setting, in which learning happens in our daily lives, that is considered ripe with opportunities for learning through social venues. However, that doesn't imply that Bandura believed that all learning needed to happen in an unstructured environment. He asserts that learning is instructor-managed and that the student is at the center of their learning process. The environment around the student provides the rich resource for observing behaviours and mentally cataloging these examples for future use in their learning environments.

However, the use of teaching models may be one of the most effective strategies for teaching and learning Basic Electricity. This will involve the Basic Electricity work teachers to, first of all, demonstrate the activities and then reward the students for their good and bad responses. This is one of the ways of making and bringing learning closer to students and eventually, the learning may take place successfully. This behaviour would attract the student to be fully engaged to the activity and as well arouses their interest in learning Basic Electricity work in the technical colleges.

2.1.2 Social Interdependence Theory

Social interdependence theory was propounded by Johnson and Johnson (1985). This learning theory was based on the fact that students learn through the help of others. Social interdependence theory state that the outcome of each student depends on the contribution of the others. The perception of the theory is that each student in a group must contribute to that group since the outcome of the group depends on the contribution of other members. The main proposition of the Social interdependence theory is that achieving effective teaching and learning depends on how goals and objectives are set and how students work together (Johnson & Johnson, 2009). To attain the set goal, there is a need for positive interaction within and between the students in the classroom. The author, therefore, highlighted two types of social interdependence theory as positive interdependence (cooperation) and negative interdependence (competition).

1. **Positive Interdependence:** when each student cooperates and helps each other's in a group to accomplish the group's goals and complete the task. If the goals are to accomplish the following variables needs to be put together such as effective communication, mutual help and assistance, mutual influence, exchange of needed resources, trust and cognitive management of conflict.
2. **Negative Interdependence:** it exists when individuals perceive that they can obtain their goals if and only if the other individuals with whom they are competitively linked fail to obtain their goals and, therefore, obstruct each other's efforts to achieve the goals.

It is clear from the study of Johnson and Johnson (2009) that the positive outcomes of social interdependence are identified as: positive relationships and social support, effort to achieve, self-esteem and psychological health, intra and the inter-personal relationship between and within the group.

The social interdependence theory provides a foundation for the practice of bidirectional and unidirectional peer tutoring instructional methods. The bidirectional and Unidirectional peer tutoring instructional method is compatible with social interdependence theory in which the goal and objectives of students' will be achieved through interaction among peers. The social interdependence theory is relevant to the Bidirectional and Unidirectional peer tutoring instructional method since the set goal of the students can only come through under the cooperation of others. The implication of social interdependence theory to this study is that students learn when they interact with their peers by sharing information.

2.1.3 Constructivist Theory of Learning

Constructivism is a theory or set of interrelated doctrines and philosophies about learning in which learners construct their knowledge out of their own experiences. Constructivism suggests that knowledge is not passively received either through the senses or any means of communication by learners, but is actively constructed by them (Perkins, 2000). Rather than passive absorbers of information, learners are viewed as actively engaged in meaning-making, activating prior knowledge to bear or fit with new situations, and if warranted, adopting such knowledge structures (Perkins, 2000). Some researchers credit Immanuel Kant as the father of constructivist thought while others suggest constructivism can be traced to Socrates. Nonetheless, Wertsch (2001) discloses that various types of constructivism emerged but the two most common perspectives in science and technology education are cognitive and social constructivism.

Cognitive Constructivism

Cognitive constructivism by Baldwin (1911) and Piaget (1937) proposes that knowledge results from the personal experiences of the learner within his environment. Perkins

(2000) disclosed that coherence is the main criteria in the cognitive constructivism. Coherence in this context refer to the agreement among thought patterns within individual as new experiences and their prior knowledge are brought to bear upon each other. Cognitive constructivists maintain that individual is the primary actor in the process of meaning making during the learning process. In other words, cognitive constructivism views knowledge that is constructed as personal and uniquely determined by each learner.

Social Constructivism

Social constructivism by Vygotsky (1978) views knowledge as a cultural product. It proposes that knowledge is best obtained from social interaction. Viability of knowledge claims are judged based on the level at which consensus is achieved from the various conceptions and experiences of members in a culture. Proponents of social constructivism argue that knowledge is constructed not only from personal experiences, but from social interaction with others (Dixon-Krauss, 2006). Several instructional approaches emerged from social constructivism's that include: cognitive apprenticeship, collaborative learning, cooperative learning, problem solving learning and bidirectional peer-tutoring instruction. Therefore, the study adopted constructivism learning theory because it is the root of bidirectional peer-tutoring instruction.

In Vygotsky's social constructivism, social interaction is an important way by which children learn. Children learn through social interaction with teachers, adults, parents, guidance and friends. Students are actively involved in learning from teachers and peers through communicating processes by explaining their problems, projects and exercises to them. Vygotsky's work stressed advantages in collaborating with peers through group work will be an added advantage to him/her. Piaget's study identified the important of intellectual relationship between learners that encouraged them to search for more

information in order to gain more understanding. In the cognitive aspect of constructivism theory believes that learners must involve in the way to search for new materials that that can solve his/her problem. According to this theory, truly a readymade knowledge do not exist, but something related exists somewhere in the form of collective ideas within the specific discipline or culture which called for mutual interaction and active involvement of individuals before it can be acquired (Piaget, 1937).This theory is related to this work because the Bidirectional and Unidirectional peer tutoring method focuses on sharing of information, cooperative learning, inquiring, self-discovery and learning among peers.

These theories have been chosen as the basic theoretical framework for the application of Bidirectional and Unidirectional peer tutoring Instructional approaches. As a result of this review, all of these theories emphasize on social interaction, sharing of information, cooperative learning, learning from peers and parents. Learning depends on their previous knowledge, and allows students to construct their knowledge. In addition, the learning environment should be set to give room for social interaction and self-learning. Teachers are therefore salving as instructors, facilitators and guides.

2.2 Conceptual Framework of the Study

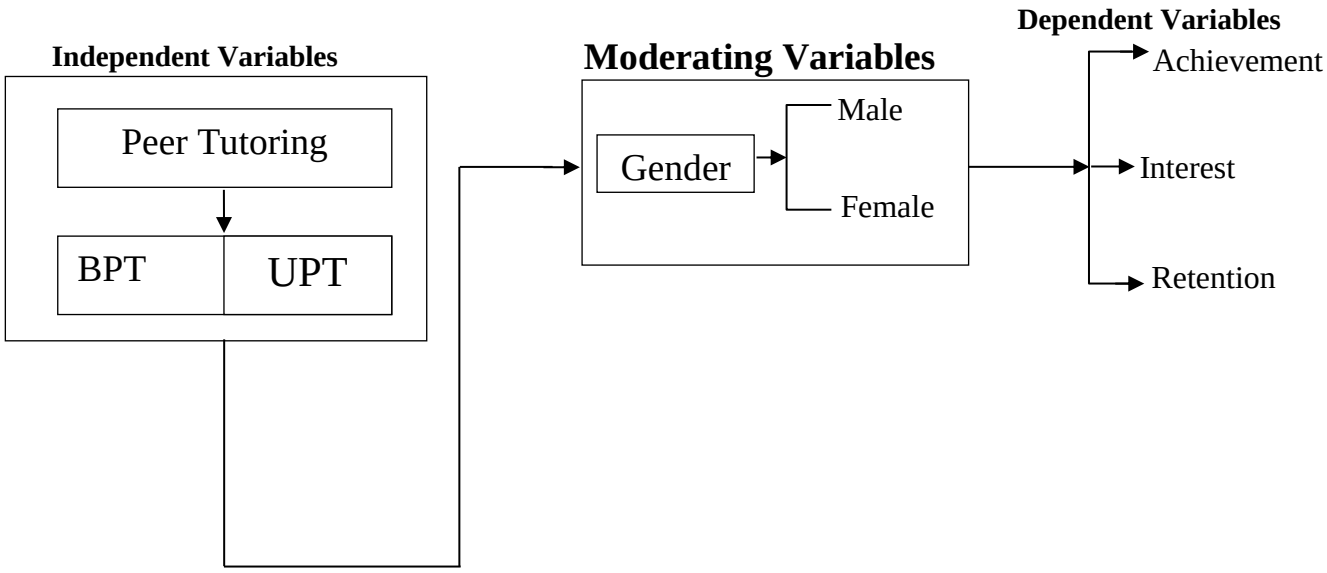


Figure 2.1: The Schematic Diagram of Conceptual Framework (Researcher)

The framework in Figure 2.1 indicates that the Basic electricity teachers derived his/her lesson and teach selected topics with the bidirectional and unidirectional peer tutoring instructional approach. The students were exposed to each teaching method. The most effective teaching method for teaching basic electricity is expected to yield higher student achievement, interest and retention.

2.2.1 Concept of Peer Tutoring

Peer tutoring has a long history of existence and was reported to be used as an alternative teaching method in school as well as in the institution of higher learning (Costantini, 2015). The author also stressed that, in United Kingdom (UK), the development of peer tutoring started in the late eighteenth century and has become part of the education system. There is an increasing awareness of the benefits of peer tutoring and an increasing number of Colleges and Universities throughout the UK integrating Peer tutoring as part of the instructional method (Oczkus, 2018). Unfortunately in Nigerian Colleges, Peer

tutoring which is learner-centered Instruction is still relatively new and not used widely. Very often, instructions in Nigerian Colleges are teacher-centered whereby interaction among learners is minimal. One will see some phenomena such as imitation, group formation, and group play of different types. One will equally observe some students teaching other students. This is peer tutoring that occurs in the school and is student-initiations, as children spontaneously help their peers, mates, and friends. Igbo (2018) pointed out that peer- mediated intervention can be organized such that students are assembled in groups of two or more and are trained to work together on a specific academic task. These students take turns acting as the tutor and the tutee for instruction and review of academic material with the teacher's supervision.

Peer-tutoring is productive and successful because a hierarchical atmosphere in the classroom is removed and a cordial and free atmosphere that encourages learning is attained. During Peer-tutoring, fear of criticism in the students is removed, blame or punishment from the teacher when they are not coping as the teacher wants is also removed. Igbo (2018) further classified Peer-tutoring instructional approaches into Class-wide peer-tutoring, Cross-age peer-tutoring, Reciprocal peer-tutoring, Bidirectional peer-tutoring and Unidirectional peer-tutoring. But in the context of this study, we shall be considering Bidirectional and Unidirectional peer-tutoring.

a. Concept of Bidirectional Peer Tutoring

Bidirectional Peer Tutoring (BPT) is a structured cooperative learning programme where students function both as tutors and tutees. In this structured BPT programme the higher and lower-achieving students are paired together to gain knowledge from each other's practice and reinforcement. The reinforcement they receive while working in groups motivates learning. These could also provide a great deal of student-student interaction

so that learners can acquire concepts from those whose interpretations are closer to their own (Vygotsky, 1978). BPT is firmly supported by Vygotsky (1978) theories regarding knowledge acquisition and complementary relationships. In this complementary relationship, the tutor is more knowledgeable in an area than their tutees. Igbo (2018) saw bidirectional peer tutoring as a teaching process whereby the teacher shows a student how to perform a skill and the student, in turn, trains a second student on the same or similar skill.

BPT is the type of peer tutoring which involves two or more students grouped, preferably in a pair consisting of a higher achieving student with one with low performance. Each student in the pair monitors and assess the other, which provides a sense of equal status among colleagues. Cervantes *et al.* (2018) pointed out that BPT is an innovative way to maximize classroom resources and promote a more effective and dynamic experience for all students. The author further stressed that it is a technique that breaks the entire class into pairs or small groups of four to six students. As the tutee performs each task, the tutor provides feedback and records the number of correct performances. Each student in the pair or group is involved in the reciprocal roles of tutor and tutee. This strategy provides a way for all students to be partnered with one another. BPT which is also called Class-wide peer tutoring allows more practice time and increased opportunities to perform desired skills accurately thereby promoting success (Cervantes *et al.*, 2018).

Bidirectional peer tutoring was developed and tested for children with academic needs (Pigott *et al.,* 2004). 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 toward group goals (Fantuzzo *et al*., 2010). Students alternate between the roles of tutor and tutee in groups of two. In

larger groups of three or four, the roles of a group monitor and an evaluator are added to the procedure. The students work together in their groups to achieve established goals or rewards that are contingent upon group achievement. There is an assumption that bidirectional peer tutoring has been effective in increasing academic achievement in areas of Mathematics and vocabulary (Fantuzzo *et al*., 2010). Igbo (2018) identified three of the basic principles underlying BPT interventions as increasing academic engagement, increasing the opportunity to respond, and increasing timely feedback regarding students' achievement.

Another important component of BPT is the incorporation of rewards contingent upon the achievement of each group member. BPT requires that the students set a goal to be reached for each session, and the students earn points for correctly responding to academic tasks. BPT requires each member of the group to contribute to the attainment of the goal and ensures that no one person can be responsible for the group's success (Oczkus, 2018). The creation of BPT is in some ways a compilation of four comprehension strategies: summarizing, questioning, clarifying and predicting. It conjures up the image of a student in front of the class, or of students taking turns telling each other important ideas in the text. The order in which the four stages occur is not crucial; one may want to try out different versions of the strategy to see if a particular protocol suits one's teaching style, and one's students' learning styles, better. One may also want to choose text selections carefully to be certain that they lend themselves to all four strategies of BPT. However, before one can adopt bidirectional peer tutoring to be used successfully by one's students, they need to have been taught and had time to practice the four strategies that are used in bidirectional peer tutoring. It does make sense, therefore, that they should already have learned and become comfortable with

summarizing before attempting to use it in a bidirectional peer tutoring strategy, and they should even have been comfortable with questioning, predicting or clarifying (Ene, 2012).

One approach to teaching bidirectional peer tutoring might be to have students work from a four-column chart, with each column headed by the different activity group involved. One might also consider implementing bidirectional peer tutoring the way McMahon of the North West Regional Education Service Agency in North Carolina recommends. Here is one way she suggests one uses bidirectional peer-tutoring instruction:

1. Put students in groups of four or five
2. Distribute one note card to each member of the group identifying each person's unique role:
    a. Predictor
    b. Clarifier
    c. Summarizer
    d. Questioner
3. Have students read a few paragraphs from the assigned task. Encourage them to use note-taking strategies such as selective underlining or sticky notes to help them better prepare for their role in the discussion.
4. At the given stopping point, the summarizer will highlight the key ideas up to this point in the instructional task.
5. The Questioner will then pose questions about the selection.
6. The clarifier will address confusing parts and attempt to answer the questions that were just posed
7. The predictor can offer guesses about what the topic will tell the group next or, selection, the predictor might suggest what the next events in the note will be.

8. The roles in the group then switch one person to the right, and the next selection is read. Students repeat the processes using their new roles. This continues until the entire selection is read.

Effective bidirectional peer tutoring lessons include scaffolding, thinking aloud, using cooperative learning, and facilitating Metacognition with each step (Galloway, 2017). Thinking aloud and discussion of thoughts aid clarification and revision of thinking and learning, therefore developing cognition. Vygotsky's theory of Zone of Proximal Development (ZPD) is critical to identifying appropriate tasks and scaffolding activities to support student success (Galloway, 2017). Appropriate support and feedback must be given to facilitate learning during BPT activities (Oczkus, 2018). Different rationales underline the use of students as teachers of other students. Some arguments are derived from the theory of cognitive development. This theory has many ideas about the role of bidirectional peer tutoring. Especially influential has been Vygotsky's conception of the Zone of Proximal Development (ZPD) which stresses student's benefit from interaction with more competent peers (Galloway, 2017). Social learning theory has shown that students who doubt their learning capacities are influenced by the behaviour of others with a high sense of efficacy in a particular task through the models they provide. According to Igbo (2018) it is clear that many peer-tutoring achievements have benefited those tutored, producing gains both in school achievement, interest and retention on standardized tests. This implies that bidirectional peer-tutoring programmes are part of the curriculum in many schools outside Nigeria.

b. Concept of Unidirectional Peer Tutoring

Unidirectional Peer Tutoring (UPT) is a model of tutoring involving students who are more advanced in a peculiar skill serve as tutors for students who need special support

and encouragement in learning identified concepts, applications, and skills. UPT which is referred to as One-on-One peer tutoring occurs when only one student is trained to serve as a peer tutor to lower-achieving students. Utilizing the Unidirectional type of tutoring in teaching Basic Electricity Syllabus, will allow the lower-achieving students to receive additional support and attention from the higher achieving students. And the advantage of using UPT is that both students know their roles (Cervantes *et al.*, 2018). UPT is characterized by specific role-taking and a high focus on curriculum content. The process in a study by Topping and others used what is known as the Duo log Math technique and followed an eight-step process: Read the problem out loud; Listen; Check for the correct response; Praise and encourage; Pause for think-aloud-give tutee time to think; Question-ask helpful and intelligent questions which give clues; Make it real-try to make the problem seem real and related to the tutee life; summarize and generalize key strategies (Topping *et al.*, 2011).

UPT intervention includes both cross-age peers, and the selection of tutors is generally based on the ability level and the willingness of tutors to support their peers with lower performance. In UPT approach, tutors are often required to select instructional procedures that fit the instructional context rather than simply implement an instructional script. For example, Topping *et al.* (2011) trained their peer tutors to use strategies from a menu of supports, giving them the autonomy to choose the support procedures that were the best contextual fit for the activity they were engaged in. This flexible and adaptable format is essential for peer tutors when they are expected to deliver support in settings moreover, tutors are often given the autonomy to decide which strategy should be delivered based on a particular situation. Tutors are then provided feedback based on their decision-making and strategy implementation.

A targeted student peer tutoring intervention that utilizes a unidirectional format may be particularly applicable for supporting students with low academic achievement in secondary settings. While research is available to support the effect of unidirectional peer tutoring on social skills with students with low achievement, there is a dearth of research on the effects of providing unidirectional peer tutoring to targeted students on academic achievement for students with low retention and students with poor academic performance. Okilwa and Shelby (2010) assert that further research is needed to establish the effectiveness of peer tutoring in introducing more complex cognitive strategies such as comprehension strategies, critical thinking, math concepts, or application.

2.2.2 Basic Electricity in Technical Colleges

Basic electricity is one of the science and technology subjects offered in technical colleges in Nigeria. And it is a compulsory subject to be offered by every student willing to make a career and continue in the field of electrical /electronic technology or related field. Basic electricity is a trade related module of the National Technical College syllabus designed to provide the trainees with basic knowledge and practical skills of electrical /electronics. The objectives of Basic electricity as contained in NBTE syllabus (NBTE, 2013) are that at it completion the students should be able to demonstrate an understanding of the: Structure of matter and its relevance to electricity, chemical sources of electromotive force, resistors, capacitors and inductors, values and functions of resistors, the values of resistor (s), Ohm's law and its application, Distinguish between AC and DC quantities, simple electrical circuits, principles of transformers, its construction and operation, electronic sign and symbols, indicating instruments.

Basic electricity in technical colleges is a subject that prepares students with entry-level knowledge to enable them to do better for all subjects offered in the field of electrical

related trades. Ogbu (2018) described Basic electricity as a process that deals with all the fundamental issues of current electricity, Static-electricity and electronics, studied in the school and colleges. Basic electricity is a course in technical colleges that equips individuals with specific skills, knowledge and attitudes to enable them to maintain, repair and construct basic electrical /electronic systems in practice (Nweke, 2017).

Therefore, Basic electricity is the fundamental subject of study in the field of electrical and electronics that is taught in technical colleges. The programme aimed at equipping the Basic electricity students with functioning and saleable skills, knowledge and attitudes to be enterprising and self-reliant with skills in domestic and industrial installation, as well as operates, maintain and repair electrical and electronic equipment's, among others. Basic electricity programmes in technical colleges provide technical training to meet the demands of the electrical industry and the needs of the individual allowing the students to identify their career objectives (Ogbu, 2018). The author also stated that the objectives of the programme are to give training and impact needed skills to technical college students in that area to enable them to secure employment in a recognized organization, create a job or become self-reliant economically. The graduates of Basic electricity at the technical college level have three options: the options according to the Federal Republic of Nigeria (FRN, 2014), is to either secure employment in the industries, set up their own business and become self-employed and be able to employ others or to pursue further education in advance craft in higher technical institutions. This type of education produces technologists, technicians, craftsmen and skilled artisans who will be relevant in various sectors of technological development that can help transform the economy of any nation (Ogide, 2017).

Basic electricity, therefore, is a subject that is concerned with physical phenomena associated with the flow of electric charge. Taale and Mustapha (2014) stressed that Basic electricity helps students to understand the mechanism behind the various effects of electricity such as lightning, static electricity, electromagnetic induction and electrical current. In addition, electricity permits the creation and reception of electromagnetic radiation such as radio waves. The major objective of Basic electricity is to enable students to acquire electrical skills and become proficient in elementary electricity. In the words of Taale and Mustapha, Basic electricity is directed at providing students with electrical skills that will, in the first place, help them to become self-employed, sustained and consequently earns a living from their business activities. Secondly, the knowledge and skill of basic electricity will help students to provide solutions to minor electrical problems in their environments instead of employing or inviting an external body to do the job.

2.2.3 Methods of Teaching Basic Electricity at Technical Colleges

Methods of teaching refers to the general principles, pedagogy and management strategies used for classroom instruction in a school settings. The methods are grouped into teacher-centered method and learner-centered method. Kanuka (2010) differentiates between teacher-centered and student-centered learning based on the teaching and learning experience. While teacher-centered learning prioritizes the experience of teachers or instructors, student-centered learning emphasizes the experience of the student. In some cases, teachers can employ a mixture of teacher-centered and student-centered pedagogical methods. According to Wright (2011) teacher-centered learning occurs when teachers control the delivery of knowledge, while student-centered learning shifts the power to the students, who construct their own knowledge with teacher assistance. Learner-centered instruction is the perspective that focuses on the learners' experiences,

perspectives, backgrounds, talents, interests, capacities, and needs. It creates a learning environment conducive to learning and promotes the highest levels of motivation, learning, and achievement for all learners, Teacher-centered instruction is a traditional instructional technique that is characterized by the transmission of information from a teacher, who serves as a lecturer to the student, who passively receives the content (Ahmed, 2018). Crowder and McCaskey (2015) suggested that compared to traditional teacher-centered classrooms, learner-centered courses emphasize individual learner engagement in which each student must utilize his/her current knowledge skills and abilities to apply the course information.

However, depending on the subject, some teachers may provide instruction in a teacher-centered format but also combine various learner-centered components. According to Crowder and McCaskey (2015) in a learner-centered course, the focus shifts from the content that the teacher presents to how well each student is learning. According to Mostrom and Blumberg (2012) in a traditional teacher-centered class, the teacher is responsible for learning. However, when a learner-centered approach is utilized instructors can transfer this responsibility to the students by teaching students learning-to-learn skills that correspond to the learning objectives and course assessments and allocating time for the students to practice these skills collaboratively and independently. Stefaniak and Tracey (2015) concurred and reported that the responsibility for learning is increased and student development is enhanced in a learner-centered classroom due to the diverse learning activities that promote teamwork and require the students to think critically by solving complex problems individually and collaboratively. Furthermore, Tawalbeh and Al-asmari (2015) reported that student responsibility for learning is increased when the instructor assumes the role of a facilitator who uses class time to

promote participation, cooperation, self-teaching, learner reflection and active student engagement.

It has been revealed that the teaching methods adopted in teaching at technical colleges in general and Basic electricity, in particular, are mainly teacher-centred methods which include discussion, lecture and exploratory methods (Ahmed, 2018). In a teacher centred method according to Radu (2016) the teacher predominantly lectures to a group of passive students and controls all aspects of instruction including what will be taught, how it will be taught and how long to spend on each topic. Conversely, with learner-centered teaching, the instructors and students share the verbal exchanges, and the teacher performs the role of a facilitator who engages the students who are seen as partners in learning.

Despite the call from Federal Government of Nigeria for a shift from teacher centred method to students' centred method of teaching and learning at Technical Colleges to actualize the goals of technical education in Nigeria, studies have revealed that Basic electricity teachers still adopt teacher centred methods to teach their students (Shodeinde, 2013). These methods have been criticized by researchers as methods of teaching and learning which do not give room to students to be actively involved in the teaching and learning process in the classroom whereby leads to poor academic achievement and retention (Ahmed, 2018). It was based on the shortfall in the teacher centred methods being adopted by most teachers of technical colleges, that necessitate for change in instructional strategies that will provide students with opportunities to promote their creative thinking and knowledge synthesis to develop and use higher-order cognitive skills to solve real-world problems by adopting the learner-centered approach to instruction such as constructivism teaching method, meta-learning teaching method, and peer tutoring instructional method, among others.

2.2.4 The Need for Change in Instructional Strategy

The constructivism teaching method is a learner centered approach to instruction based on constructivism learning theory that says that all learning is constructed from a base of prior knowledge. According to Akamobi (2019) the constructivism teaching method is teaching with an approach that seeks opportunities for students to analyses, investigate, collaborate, share, build and generate ideas based on what they already know rather than facts, skills, and processes they can parrot. The learner-centered approach highlights the balance of power between teachers and students. What this means is that the teachers give up some control of the course structure and become partners with the students to enhance the learning environment (Smith & Valentine, 2012). Ahmed (2018) agreed and reported that this method enables students to take ownership in their learning by having an opinion in the content to be covered and teaching methods used, which will correspond to the student's learning interests and goals. Likewise, Wei (2017) indicated that students could take ownership in their learning by aiding in the development of the course syllabus to prioritize content, create peer accountability guidelines and develop ideas for course assignments.

Likewise in facilitating students' centered learning, Weimer (2013) reported that the desirable aspect of a facilitative instructional role is that it more effectively promotes learning for two reasons. First, this role shifts the focus from what the teacher is teaching to what the students are learning. When the instructor concentrates on what the students are learning, he/she can determine the students learning skills deficiencies. Knowing student learning skill deficiencies enables the teacher to modify instructional strategies that will facilitate learning. Second, facilitative education requires the students to move from passive recipients of information to active creators of knowledge. The learners work alone or collaboratively to perform dynamic activities such as problem-solving, critical

analysis, generating questions and formulating answers, and summarizing content. Blumberg (2015) concurred and stated that the main task of a learner-centered teaching method is to stimulate learning through the comprehension and application of the course information and to promote critical thinking skills by challenging students to solve problems that relate to their field of study. The author also indicated that learner-centered teaching results in enhanced long-term retention and increased content application skills.

The shift toward learner-centered instruction represents an essential movement toward the development of independent lifelong learners who can assimilate and change with the ever-changing workforce (Cullen *et al.,* 2012). Bishop *et al*. (2014) agreed and argued that it is the instructor's responsibility to create a learning atmosphere that prepares students to be autonomous, self-motivated and continual learners. When teachers encourage students to engage in reading, writing, listening, teamwork, goal setting, and time management activities, students begin to understand the importance of creating life-long learning skills. Moreover, Schreurs and Roza (2014) suggested that students are prepared to become lifelong learners in learner-centered classrooms due to the experience they encounter in solving real-life problems in collaborative and social environments. Lastly, learner-centered instruction increases student's application of the knowledge to use in their careers. Bishop *et al.* (2014) indicated that the basis for teaching strategies such as problem-solving, teamwork, communication and learn-to-learn skills is that they represent significant skills that students need to have a successful career.

2.2.5 Students Achievement in Basic Electricity

Students' achievement in Basic electricity is conceptualized as a necessary change in the performance of students due to their exposure to series of programme of instruction. Odeh *et al.* (2018) referred to students' achievement as the scores students have attained in

either test or examination which determines their performance. Students' achievement in Basic electricity is defined as the ways of measuring students' behaviour and performance using a standardized series of tests. Students' achievement test is often constructed and standardized with the view to measure the proficiency of learners' in different subjects (Ahmed, 2016). Students' achievement is the addition of conceptual understanding, problem-solving skills, and procedural knowledge development. Students' academic achievement is dependent upon several factors, among which includes the teaching method, intelligence, background, organization, opportunity and motivation (Arul & Vimala, 2012, Antherson 2013: Akanwa & Ovute 2014). These factors were grouped into three by Adekunle (2017), the environment, the learner and the school factors. The environmental factors are the school social climate, home background, and peer influence. The learner factors include the learners' mental ability or level of intelligence, his goals and purposes, his identification with learning maturation, the extent of readiness and motivation. The school-related factors Include the teacher's personality, method of teaching, guidance, availability of facilities and Method of testing the learner's.

Innovations in teaching methods and techniques that have been used in teaching Basic Electricity seem not to have positively influenced the achievement of students in Basic Electricity, since achievement remains poor (Saka-Alikinla *et al.,* 2019). The situation raises some doubts as to whether there are other variables such as peer tutoring instructional approaches that can inhibit achievement in Basic Electricity. However, Ali (2014) pointed out that students will be able to achieve better if the required instructional techniques and materials are appropriately and effectively utilized. Academic achievement refers to the successful result of interaction between a teacher and a student (Igbo & Ihejieme 2015). It is designed to measure an individual level of skill accomplishment or knowledge in a specific area. Academic achievement is appropriate

in determining the efficacy of instruction and also useful in testing the retention of information and skill**.**

2.2.6 Student interest in learning

Student interest is an important variable in learning because when one becomes interested in an activity, one may likely to be deeply consumed in that activity. Interest could be referred to as a sense of concern with and curiosity about something (Silvia, 2018). It is the act of showing favorable curiosity or concern about somebody or something. Students' interest in the learning tasks determines their learning styles and cognition which in turn determines student achievement. The major determinant of students' Interest in learning a task largely depends on the instructional strategies or methods of teaching adopted by the teachers. Several results from researchers showed that students' interest can be aroused and sustained when a better instructional strategy is used in the teaching of the subject. If the lesson is not interactive, it makes students not to be interested in the learning situations and makes them hate or even reject subjects in the schools.

Individual interest is considered to be an individual's predisposition to attend to certain stimuli, events, and objects. Situational interest is elicited by certain aspects of the environment. These include content features such as human activity or life themes and structural features such as how tasks are organized and presented. Topic interest, the level of interest triggered when a specific topic is presented, seems to have both individual and situational aspects. In his designed framework termed Interest-Driven Learning (IDL), Shehu (2015) address two major challenges to the design of Interest-Driven Learning. The first challenge is motivating the broad range of learning objectives that are valued in our educational systems, many of which do not appear to hold any interest to their intended audience. We call this the challenge of coverage. The IDL framework addresses

the challenges of coverage through strategies for creating relevance for learning objectives. The second challenge is accommodating the variation in the motivational strength of interests among different individuals and within the same individual at different times. We call this the challenge of strength through the use of a variety of types of motivation to supplement interest. The IDL framework is designed to take advantage of the unique benefits of interest as a motivator for learning.

Interest according to Okoro (2016) refers to activities or things, a person likes or dislikes. It is the act of showing favourable curiosity or concern about somebody or something. Students' interest in the learning tasks determines their learning styles and cognition; which in turn determines students' mean terminal cognitive achievement. The major determinant of students' interest in the learning task on any subject matter is the existing instructional system or teaching methods adopted by teaches especially in science-based subjects. Traditional teaching methods are teacher-centered and therefore do not involve the active participation of the learners in the teaching-learning process thereby retarding student's interest (Eze *et al.,* 2019). As teacher-centered instructional methods and strategies retard student's interest in science subjects; it also hinders student's interest in Basic Electricity.

Poor students' interest in Basic Electricity has far-reaching negative effects on national technological advancement Ogwa (2002) posited that there is nowhere in which technological advancement and explosion is more apparent than in the field of electrical electronics. This is true because the present civilization and technological advancement world over are electrical and electronics advancement and breakthrough such high sounding terms as globalization, internet computers', industrial drive/mass production, satellite communications, radar communication/general telecommunications e-learning,

e-commerce, e-banking among others are all through electrically electronics breakthrough of which baric electricity is the basic. Hence, poor students, interest in the study of Basic Electricity at the secondary education level spells doom on the nation. Low interest in general terms signifies that the students will have poor outlook in all aspects or dimensions of interest in Basic Electricity. This will lead to loss of technical manpower in all service areas of electricity electronics by the time the students would have graduated and be in the world of work.

2.2.7 Retention of Learning

Retention is measured in collaboration with academic achievement. This means that retention of learning by students leads to students' academic achievement. Retention is the capacity to prompt performance and embrace such performance for periods of time (Atsumbe *et al.,* 2019). The authors stressed that retention is the rate at which students performed in a subject's area in terms of skills and knowledge acquired over time. Therefore, retention can be defined as the ability of Basic electricity students to be able to keep the knowledge acquired and recall it over a period of time. Retention is the ability to hold, preserved, keep or recall past experience and reproduce a learned concept when the need arises. It is an important variable in learning because only a learned experience is recalled, learning cannot be said to have taken place if there is no proper retention. Retention as one of the variables in this study is a significant goal of education. The method to be used for effective teaching and learning and for the learned material to be retained is a matter of great concern to teachers and educators. Ezugwu (2016) stated that no single method of teaching has been found to provide all it takes for reasonable retention of knowledge by learners.

Retention interval is the time that elapses between a test of original learning and that of a retention test. Therefore, knowledge retention of learning is defined as the proportion of knowledge retained by an individual after a specific retention interval. The period between the completion of training and subsequent performance of the trained skill is conventionally referred to as the "retention interval". (Haynie, 2013) defines retention of learning as learning which lasts beyond the initial testing and is assessed with tests administered two or more weeks after the information has been taught and tested. The author further stressed that retention of learning is measured with two tests: the initial test and the delayed retention test. The initial test is the test employed at the time of instruction or immediately thereafter while the delayed retention tests are those tests administered two or more weeks after instruction and initial testing to measure retained knowledge.

For the purposes of this study, retention is defined as the ability to keep the knowledge of basic electricity learned and to be able to recall it when the need arises. Retention helps in knowledge development and knowledge development can be achieved when students are actively involved in the teaching and learning process. Kirschner *et al.* (2016) confirmed the statement when they said that students learn and retain more when they can develop their knowledge and meaning from their own experience. Retention in basic electricity is not acquired by mere memorization rather through students' participation rooted inappropriate teaching methods. Eze *et al.* (2020) stated that the use of appropriate teaching methods could avail students the opportunity to learn from what they know and as well grasp practical skills. Instructions in technical colleges are skill-oriented and for the instruction to be effective students' active participation must be considered. It is, therefore, necessary to provide students with opportunities that will promote their creative thinking and knowledge synthesis to develop and use higher-order cognitive skills to

solve real-world problems by adopting the learner-centered approach to instruction such as constructivism teaching method, meta-learning teaching method, among others.

Research has, in general, proposed three main principles of knowledge retention. Firstly, knowledge retention generally falls to 75-89 percent of its original level after a relatively short period. Secondly, the retention rate decreases over time as a finding of the length of retention interval in a relatively linear manner. Thirdly, all performers regardless of their levels of achievement have similar knowledge rates. Retention is generally affected by two very important variables. These include; duration of the study session and the temporal distribution of study time across the session. Retention of learning is the primary goal of every teacher. However, in today's school, it is common for a student to learn material take a test and forget the material soon after. It is therefore important to consider knowledge retention when evaluating learning strategies. The above information concerning the retention of the material taught indicates that certain instructional approaches enhance retention of learned items overtime when effectively utilized, which is facilitated by using relevant teaching strategies revisiting and exploring the material taught. Ezugwu (2016) opined that a given method may be of great value to one teacher while the same method may lose much of its value in the hands of another teacher especially if the latter believes that a different method is better. Vanessa (2017) stressed that when instructional standards are taught using the effective method it will increase the student's achievement and retention irrespective of gender.

2.2.8 Gender and academic achievement

Gender is one variable that could always be a factor in the issue of students' academic achievement. Gender differences in academic achievement have been of great concern to researchers and education policy makers both local and international. It is one of the

current academic issues under deliberations all over the world (Abdu-Raheem, 2018). Undoubtedly, the gender of students may have influence on academic achievement of Basic electricity irrespective of the fact that the FRN, (2014) through its National Policy on Education has provided for equal opportunities for all citizens to study all subjects in schools irrespective of their gender. Gender is the range of physical, biological, mental and behavioral characteristics about and differentiating between the feminine and masculine (female and male) population (Adigun *et al*., 2019).

The importance of determining the academic achievement of students concerning gender is based primarily on the socio-cultural differences between girls and boys. Some vocations and professions have been regarded as men's; like; engineering, arts and crafts, agriculture. While others have been regarded as women's; like, Catering, typing and nursing. Gender refers to psychological terms, that describe behaviours and attributes expected of an individual based on being a male or a female. Gender is also one of the factors that influence students' academic achievement in Basic electricity at Technical colleges. Studies have shown that gender has a significant influence on student achievement. The findings is somewhat divided in different researches. While some research (Amogne, 2015; Olasehinde & Olatoye, 2018; Owodunni & Ogundola, 2018) have reported the most significant difference between male and female students' academic achievement, others (Hashim, *et al.*, 2015; Lin, 2015) found out that there is a statistically significant difference between male and female academic achievement in favour of the male students. Yet, other studies showed a significant difference in favour of girls (Voyer & Voyer, 2014).

But concerning gender and academic achievement, it has been revealed in a survey study conducted by Olasehinde and Olatoye (2018) to compare male and female learning

outcomes in science based on students' attitudes towards science and academic achievement, the result revealed no statistically significant difference between male and female students in overall science achievement as well as in attitude to science. Even so, in both science achievement and attitude, female students had higher mean scores than male students. The trend now is for people to pay attention to educating the female child in Nigeria. It is now a common saying that "what a man can do, a woman can do it better". Therefore, it will be a fruitful exercise to look at whether the sex of students affects their academic achievement when taught with a Bidirectional and Unidirectional peer tutoring strategy.

2.2.9 Gender and academic interest

Gender has been defined differently by different sources. Central to all the definitions is that gender denotes either male or female as characterized by society. Academic interest is the interest of a particular study about a particular subject matter. Gender and academic interest in a particular subject depend on the affective domain of the learner or students towards that subject. Interest is described as a social construction developed within the dynamic relationship between the individual and the situation. Interest could also be referred to as a sense of concern with and curiosity about something (Silvia, 2018). Therefore, student's interest in learning is associated with anxiety to learn. Interest is fundamental in any individual choose task. It consists of feelings and tendencies toward concrete matter which will result in the improvement of learners' achievement. Interest refers to a feeling of curiosity or concern about something that makes the attention turn towards it. It could also be regarded as a pre-determinant of one's perception that is what aspect of the world one is most likely to see always (McClnerney *et al.*, 2015). It could also be viewed as a condition in which an individual associated the essence of certain things or situation with his needs or want. Most researchers like, (Krapp, 2010; Hidi &

Baired, 2006; Silvia, 2018), believed that interest emerges from an individual interaction with the environment.

Interest is viewed as an expression of likeness or dis-likeness which plays a significant role in the teaching and learning process. Krapp (2010) maintained that the learners/students' interest is enkindled or killed through participation, experience and familiarity in the teaching and learning process. For such reasons, Moore (2010) emphasized that unless the teachers stimulate student's interest in learning by using the most appropriate instructional approach, the student's academic achievement would be less fruitful. Interest in Basic Electricity could be achieved, if the instructional approach used in teaching students of Basic Electricity is made students centered which allows them to participate fully in the teaching and learning process rather than remaining passive in the learning process.

Several studies show that students centered instruction used to arouses students interest in a particular trade, such study include that of Ogbuanya and Owodunni (2016) which found that the mean scores of reflective inquiry technique on students interest in Radio-Television and Electronic work is higher than the mean interest score of a conventional method. Nevertheless, Obo (2012) found that there was a significant difference between the mean interest scores of the student in the experimental group is higher than those in the control group. From the above, interest is seen to play a mediational role in students' academic achievement especially between instructional and academic outcomes. The interest of a student in any course is borne out of motivation and the instructional approach employed by the teacher in the course of his teaching. Therefore the study tries to find out the instructional approach that will facilitate the learning of Basic Electricity for both genders in the technical colleges.

2.2.10 Gender Issues in Technical Education

Technologies, technicians and craftsmen should be equally accessible to both male and female students. Yet, as girls enter adolescence, a large number of them tend to lose interest in science, mathematics and technology education. Girls are narrowing the gender gap in science and technology education. The gender factor has assumed prominence in Science, Vocational and Technical Education discourse. It has been documented that disparity exists between male and female students' performance in these disciplines. Concerning the gender gap in science and technical education, UNESCO (2015) defined gender gap as a degree of imbalance between males and females in access and participation in science and technology subjects or the differences between gross enrollment of males and gross enrollment of females in science and technology subjects. Gender schema tends to relate most of the vocational trades to the masculine gender, and show remarkable similarities as well as considerable differences in teaching-learning evaluation. Differential performance of the sexes in technology education has now become an issue of interest.

Lack of female role models is believed by some experts to be yet another reason for the gender gap in technology use between males and females. Therefore, parents should closely examine what they say to children with their actions and words. Those around female students have great potential to influence their perceptions concerning technology. Parents, teachers and the educational system can shape the self-images and futures of girls as they approach technologies. Children should be exposed to technology at an early age. They should learn that technology is fun and helpful to use, see it as one of the many tools in our world that make life easier and be ready to be an active participant in using it (Adigun *et al.,* 2019). Another opportunity to encourage female students' use of technology is to get the girls involved in gender-specific clubs such as a girl's computer

club. Discussing technology with girls is another way for parents to encourage them. Parents should ask female children about their likes and dislikes of Technical trades as they affect their lives, and issues surrounding the technical trades. Sharing and validating students' opinions strengthens their confidence. Parents and teachers should be role models for their students. As students often intimate their priorities, attitudes and actions.

Teachers should strongly encourage and praise girls for their abilities and ideas instead of doing so only for their appearance and cleanliness. If girls are praised for their skills, creating an idea, they will desire to strengthen or develop them. Administrations should put policies in place that ensure equal exposure to technology for all students. However, Silvia (2018) further pointed out that all students should have equal accessibility regardless of sex, race, socioeconomic background, or disability. Teachers need to be informed of innovations in classroom management plans and teaching strategies that are fair and equitable to all students. Teachers need to be knowledgeable about the guidelines and policies of their schools concerning gender issues. According to Chukwu (2012) teachers should:

1. Make sure they are dealing with infractions of discipline policy equally. Boys and girls should be treated the same whether the incident involves a sight on the school grounds, threats, or other means of breaking down rules.
2. Refrain from pitting girls against boys in class. This leads to name-calling and stereotyping.
3. Equally praise boys and girls for intellectual skills. Boys tend to receive more praise for these skills while girls tend to be praised for social skills such as teamwork and compromising.

4. Students should be called on equally to answer questions. Boys tend to offer answers to questions ask in the class than girls. Research shows that often time's girls are neither called on nor offer answers to questions.
5. Review educational materialism, especially technology, for stereotyping and gender. Teachers rarely have the authority to make curriculum alternations: issues raised by these materials can be a valuable learning experience for students.
6. Encourage a cooperative learning environment. Teamwork and cooperation are beneficial to female students. Girls are often more comfortable sharing in small groups, and often do not work as productively in competitive environments. There is much that teachers can do in the classroom to encourage females to reach their potential thus empowering them to see themselves as equals in technology education use and beyond.

2.3 Related Empirical Studies

Evans (2010) carried out a study on the effects of unidirectional peer tutoring on academic achievement and social interaction of students with emotional behaviour disorders (EBD). The purpose of the study was to determine the effectiveness of an author-developed treatment, Teaching Ourselves Positive Skills (TOPS), to increase academic scores and positive tutoring behaviour of students with EBD. The multi-component intervention combined best-practice strategies for reciprocal peer tutoring, direct instruction, token economy, self-and peer – management, and planning for generalization. The ten-week study was implemented in a 4th - 5th-grade classroom in a public separate school for students with EBD. Six students participated in the programme, although data were collected for two students only, those who met established criteria of documented academic and social deficits and 1Q scores above 70. They were 10- and 11-year old

African American boys who were completing schoolwork at the 1st – 2nd-grade level and were having substantial difficulty with peer relationships.

Multiple probes across academic behaviour design were used to determine the effectiveness of TOPS in increasing scores in Mathematics and spelling. Accuracy with which the target dyads performed the intervention and inter scores reliability of academic probes were recorded. Student and teacher acceptability surveys were completed after training and after the intervention. Academic scores increased from baseline to treatment phases for both students, although limited data points and divergent baseline trends suggest a cautious interpretation of results. Single replication across additional facts and two sets of spelling words indicate a tentative relationship between TOPs and scores for both students. The dyad adhered to tutoring protocol with 85% accuracy overall. Inter score reliability of academic probes was 100%. Positive tutoring behaviour in the generalized setting increased substantially after students received explicit instruction in the second set. Students and teachers found TOPS fun, easy, and beneficial for improving academic and peer interactions.

This study relates to the present study in that unidirectional peer tutoring is used which is one of the focuses of the present study. However, the study differs in terms of geographical location, the scope of the study, sample size, population, subject area and respondents. Therefore, since the study showed the effectiveness of unidirectional peer tutoring for improving students' academic achievement scores, it becomes necessary to find out if bidirectional and unidirectional peer tutoring adopted by the researcher will provide similar benefits in improving academic achievement, interest and retention of Basic Electricity students in technical colleges.

Uroko (2010) carried out a study titled: effects of training in bidirectional peer tutoring strategy on achievement, interest and perceived self-efficacy in reading comprehension of senior secondary school students. The influence of gender and gender groupings on the achievement, interest and self-efficacy of students were investigated. The study was carried out in Enugu State, Nigeria. Four research questions were generated and four null hypotheses were formulated to guide the study. The study was a non-equivalent control group quasi-experimental design, involving one treatment and one control group. A total of 174 senior secondary class two students from four co-educational senior secondary schools in Obollo Afor Education Zone made up the sample for the study. In each school, one intact class was randomly selected and the intact classes were also randomly assigned to experimental and control conditions.

Three instruments namely: Test of Comprehension (TOC) forms I and II, Students' Reading Comprehension Interest Rating Scale, Students' Self-efficacy Rating Scale and two training programmes namely: Bidirectional Peer Tutoring Strategy Lesson Plan and Conventional Lesson Plan, were developed, by the researcher. The bidirectional peer tutoring strategy lesson plan was used for the experimental group while the control group received training using the conventional teaching method. The data obtained were analyzed using mean scores, standard deviation and 2 x 2 analysis of covariance (ANCOVA).

The major findings of the study were that intervention using bidirectional peer tutoring strategy significantly improved the achievement, interest and perceived self-efficacy in reading comprehension of senior secondary school students; that gender had no significant influence on the achievement, interest and self-efficacy in reading comprehension of students based on the bidirectional peer tutoring strategy; that gender

grouping was not a significant factor in the achievement, interest and self-efficacy of students in reading comprehension; that the interaction effect of bidirectional peer tutoring strategy and gender on achievement, interest and self-efficacy in reading comprehension of students was not significant. A major educational implication of the findings was that training in bidirectional peer tutoring strategy improves achievement, interest and self-efficacy in reading comprehension and this suggests that teachers would achieve better results if trained on how to use BPT strategy. It was thus recommended that emphasis should be given to equipping students with the relevant skills in using bidirectional peer tutoring strategy and that teacher preparation institution should incorporate BPT strategy in the relevant areas of the curriculum units and expose both the pre-service and in-service teachers to this strategy learning.

This study relate to the present study in that bidirectional peer tutoring is used which is one of the focus of the present study. Furthermore, the two studies are related in terms of design as both employed pretest-posttest design. However, they differ in terms of subject area covered, population and geographical area of the study.

Ezenwosu (2013) carried out a study titled: effects of bidirectional peer tutoring and conventional lecture method on students' achievement and interest in biology in Aguata Education zone of Anambra state. Aguata zone is one of the six education zones in Anambra State. There are 47 secondary schools in the zone. Aguata Education zone was chosen for this study, due to negative effect of business on the youth of the area which leads to partial concentration in their academic pursuance. Four research questions and six hypotheses were used to guide the study. The design adopted for this study is Quasi-experimental design. Specifically the design is a pretest-posttest control group design. The populations of this study comprised of 1731 SS II students. The students sampled for

this study comprised 228 students in SS II from two co-educational secondary schools in Aguata Education Zone. In each of the two schools chosen, all arms in SS II which comprised 110 students for experimental and 118 for control group were used. One class for experimental group in which peer tutoring approach was used and the other one conventional lecture method were used as control group.

The regular biology teachers of the sampled classes were trained and used in administering the two instruments BAT and BIS which were used by the researcher for data collection. The reliability of BAT was determined using Kuder-Richardsons formular 20 (k-R20). The internal consistency index obtained was 0.70. The reliability of Biology interest Scale (BIS) was determined using Cronbach alpha. The estimate of internal consistency computed for the instruments was 0.98. Mean and standard deviation were used for data analysis. Hypotheses were tested at 0.05 level of significance using the Analysis of Covariance (ANCOVA). The results of the study revealed that students taught biology using peer tutoring approach performed significantly better in BAT than those taught biology using conventional lecture method. The result further revealed that, biology students score to a large extent depended on instructional teaching method applied by biology teachers. The interest scores of students taught biology using peer tutoring approach is higher than those taught biology using the conventional lecture method. This indicates that, instructional teaching method applied by biology teachers have effects on students mean achievement in biology. The study also revealed that gender has significant effect on student academic achievement in biology. Thus male and female students differ in their academic achievement in biology when compares the results of students taught biology using bidirectional peer tutoring approach and those taught using conventional lecture method. The study thus concludes that, given the efficacy of peer tutoring approach in fostering students' academic and interest in biology,

it is imperative for integration of peer tutoring method in teaching of biology in senior secondary schools starting from SSI students for better academic performance.

This study relate to the present study in that bidirectional peer tutoring is used which is one of the focus of the present study. Furthermore, the two studies are related in terms of design as both employed pretest-posttest design. However, the study differ in terms of geographical location, scope of the study, sample size, population, subject area and respondents. Therefore, since the study showed the effectiveness of bidirectional peer tutoring for improving students' academic achievement and interest, in Biology, it becomes necessary to find out if bidirectional and unidirectional peer tutoring adopted by the researcher will provide similar benefit in improving academic achievement, interest and retention of Basic Electricity students in technical colleges.

Tella (2013) carried out a study titled: effect of explicit and peer tutoring instructional strategies (treatment), pupil's ability and gender on learning outcomes in primary school Mathematics. Data analysis involved the use of analysis of covariance (ANCOVA). The sample consisted of 170 primary 5 pupils selected through simple random from eight schools. The findings revealed that there was significant main effect of treatment on achievement in Mathematics and attitude towards Mathematics. Pupil's ability and gender were found not to have significant main effect on achievement in Mathematics and attitude toward Mathematics. However there was a significant interaction effect of treatment and pupils' ability on pupils' attitude towards Mathematics. All the two and three ways interaction effects on achievement and attitude were found not to be significant.

These findings and application indicate that the significant main effect of treatment on mathematics achievement and attitude respectively provide empirical basis to suggest that

primary school practicing Mathematics teacher should constantly use peer-tutoring and explicit teaching instructional strategies in Mathematics classrooms. The use of these instructional strategies in improving Mathematics achievement and attitude toward the subject should also be encouraged irrespective of student pupil's ability and gender. There is also a need for developers of curriculum materials (e.g. teacher trainee's, textbook associated trainer's guide) in Mathematics methodology to incorporate the significant findings of the present study. The textual material should contain detail of hour peer-tutoring and explicit -teaching instructional strategies could be made an integral part of Mathematics teaching at the primary school level.

This study relates to the present study in that peer tutoring technique is used to investigate its effect on academic achievement base on gender which is one of the focus of the present study. However they differ in terms of population, subject area covered and geographical area of the study.

Akanwa and Ovute (2014) conducted a study titled "Effects of Constructivist Teaching Model on Senior Secondary School (SSS) Physics Student's Achievement and Interest. The study investigated the effect of constructivist teaching model on physics student's achievement and interest. The study was concluded in Abia State, Nigeria. Quasi-experimental design was employed. A stratified sampling technique was used to drawn a sample of 160 SSS physics students, categorized them into experimental and control groups. The experimental group was taught using constructivist teaching model while the control group was taught using conventional method.

The instrument used was validated Physics Achievement Test (PAT) and Physics Interest Inventory (PII) developed by the researcher, mean, standard deviation and z –test statistics were the tools used for data analysis. The findings of the study revealed that constructivist

teaching model had significant effects on both interest and achievement of SSS physics students. The study suggested that constructivist teaching model should be used by the teachers of physics to teach SSS physics students all the time. The two studies are related as both of them employed the used of constructivist teaching model and the same research design, but they differ in the subject matter and geographical area.

Zechariah (2016) conducted a study titled "Comparative Effects of Jigsaw Strategy and Peer Tutoring Strategy on Students' Achievements and Interest in Algebra. The design used was quasi experimental design, specifically pretest – posttest non-randomized equivalent group design. The population of the study comprised all Senior Secondary Two (SSSII) Students in Enugu East and Isi-Uzo Local Government Area of Enugu State. Four hundred and twenty five (425) students were used as a sample for the study. Algebra achievement test (AAT) and Algebra interest scale (AIS), were used to collect data. The instruments were validated by two experts in Measurement and Evaluation and one in Mathematics Education. The reliability of the instrument was determined using Kuder-Richardson (K-R) formula 20 for the multiple choice questions and reliability index of 0.86 was obtained. The reliability coefficient of 0.93 in Algebra Interest Scale was obtained using Cronbach's Alpha method. Six research questions were formulated and six hypotheses were tested using analysis of Covariance (ANCOVA) at 0.05 level of significant. The data were analyzed using mean and standard deviations to answer the research questions.

The findings of the study showed that Jigsaw learning strategy significantly enhanced students' academic achievement in algebra as well as students interest when compared with peer tutoring strategy. Gender had no significant influence on students' achievement as well as students' interest. However, the findings also show that, there were no

interaction effects of strategies on students' achievement as well as students' interest in algebra. It is therefore, recommended that teachers should adopt the use of Jigsaw learning strategy in their lesson in order to enhance students' academic achievement and interest in the Mathematics (especially in algebra).

However, the two studies determined the effects of peer tutoring on student academic achievement and interest. The differences between this study and the present study is that the study was conducted to determine the comparative effects of jigsaw strategy and peer tutoring strategy on students' achievements and interest in Algebra while, present will be carried out in technical colleges in Gombe state to determine the students achievement, interest and retention in Basic Electricity. The study also differ in terms of geographical location, scope of the study, sample size, population, subject area and respondents. Therefore, since the study showed the effectiveness of jigsaw strategy and peer tutoring strategy on students' achievements and interest in Algebra, it becomes necessary to find out if bidirectional and unidirectional peer tutoring adopted by the researcher will provide similar benefit in achievement, interest and retention of Basic Electricity student in technical colleges.

John (2016) carried out a study on the effect of bidirectional and reciprocal peer tutoring strategies on students' mathematical problem-solving achievement in electricity concepts in physics. The design of the study was experimental; specifically the randomized post-test only control group design. The sample consisted of 120 senior secondary two (SS2) physics students drawn using simple random sampling technique from three out of the eight public secondary schools in the study area and randomly assigned as the two experimental groups and one control group respectively. Three research questions and three null hypotheses guided the study. Treatment consisted of teaching electricity

concepts to the experimental groups using the bidirectional peer tutoring and reciprocal peer tutoring strategies while the control group was taught using a format not structured after the above strategies. Electricity problem solving test in physics (EPTP) was the instrument used for data collection. A One-way Analysis of Variance (ANOVA) was used to test the null hypotheses at 0.05 level of significance.

Results revealed a significant difference in the mathematical problem-solving achievement of students among the groups. Post hoc multiple comparison using LSD t-tests was carried out, showing that physics students exposed to bidirectional peer tutoring strategy performed significantly better than students that were exposed to reciprocal peer tutoring strategy and control group strategy. Based on the findings, some recommendations were made. Consequently, the researcher recommended that bidirectional peer tutoring and reciprocal peer tutoring strategies should be adopted by physics teachers in presenting electricity concepts to students. The curriculum planners should incorporate the teaching strategies into the physics curriculum and physics textbook for teaching electricity concepts in physics.

However, the two studies determined the effects of bidirectional peer tutoring on student academic achievement. The differences between this study and the present study is that the study was conducted to determine students' mathematical problem-solving achievement in electricity concepts in physics while, present will be carried out in technical colleges in Gombe state to determine the students achievement, interest and retention in Basic Electricity. The study also differ in terms of geographical location, scope of the study, sample size, population, subject area and respondents. Therefore, since the study showed the effectiveness of bidirectional peer tutoring when used in students' mathematical problem-solving achievement in electricity concepts in physics, it becomes

necessary to find out if bidirectional and unidirectional peer tutoring adopted by the researcher will provide similar benefit in achievement, interest and retention of Basic Electricity student in technical colleges.

Ogundola (2017) carried out a study titled: The Effects of Peer Tutoring Strategy on Academic Achievement of Senior Secondary School Students in Technical Drawing in Ekiti State, Nigeria. The study adopted the quasi-experimental research design, precisely, pre-test, post-test nonequivalent control group design which involved groups of students in their intact classes. The population for the study was all 81 SSS II students offering Technical Drawing in all Senior Secondary Schools in Ekiti State. Two research questions and three null hypotheses tested at 0.05 level of significance guided the study. The instrument used for data collection was the Technical Drawing Achievement Test (TDAT), The TDAT instrument was subjected to face and content validation by three experts. The trial test for determining the coefficient of internal consistency and stability of the instrument was carried out using Pearson Product Moment correlation statistics, Kudder –Richardson-20. (K-R.20), the value was found to be 0.70. Mean was used to answer the research questions, while ANCOVA was employed to test the hypotheses.

The result of the study indicated that peer tutoring strategy was more effective in improving students' cognitive achievement than the conventional teaching method. The study also indicated effects of gender on students' achievements in Technical Drawing favouring girls. There were no interaction effects of treatments and gender on achievement of Senior Secondary School Students in Technical Drawing It was recommended that technical drawing teachers should endeavor to incorporate peer tutoring strategy into the teaching of technical drawing so as to increase achievement and encourage students' enrolment among other recommendations.

However, the two studies determined the effects of peer tutoring on student academic achievement. The differences between this study and the present study is that the study was conducted to determine the Effects of Peer Tutoring Strategy on Academic Achievement of Senior Secondary School Students in Technical Drawing in Ekiti State, while the present study will be carried out in technical colleges in Gombe state to determine the students achievement, interest and retention in Basic Electricity. The study also differ in terms of geographical location, scope of the study, sample size, population, subject area and respondents. Therefore, since the study showed the effectiveness of Peer Tutoring Strategy on Academic Achievement of Senior Secondary School Students in Technical Drawing in Ekiti State, Nigeria, it becomes necessary to find out if bidirectional and unidirectional peer tutoring adopted by the researcher will provide similar benefit in achievement, interest and retention of Basic Electricity student in technical colleges.

Agu and Samuel (2018) carried out a study titled: Effect of Peer Tutoring Instructional Strategy on Achievement of Basic Science and Technology Students with Learning Disabilities. Quasi experimental research design was employed for the study. The population of this study comprised all Upper Basic II basic Science and Technology students with learning disabilities in Nasarawa State, Nigeria. The sample of the study was sixty-seven Upper Basic II Basic Science and Technology students from two intact classes purposively selected from two special co-education schools in Nasarawa State, Nigeria. Two research questions guided the study and two hypotheses were tested at 0.05 level of significance. Basic Science and Technology Achievement Test (BSTEAT) was used as instrument for data collection. The test was validated by experts in Science and Technology Education and trial tested. The reliability of BSTET was determined using Kuder-Richardson formula 21 (K-R21) and the reliability coefficient was found to be 0.77 implying that the instrument was reliable enough for the study. Descriptive statistics of

mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance.

The findings of this study among others revealed that peer tutoring instructional strategy has a significant effect on students' academic achievement in Basic Science and Technology. Also, the findings showed that a significant difference exist in the achievement of male and female Basic Science and Technology students exposed to peer tutoring instructional strategy. Based on the findings of this study, it was recommended that Basic Science and Technology teachers should incorporate peer tutoring instructional strategy into the teaching of Basic Science and Technology in Upper Basic schools having students with learning disabilities in Nasarawa State.

However, the two studies determined the effects of peer tutoring on student academic achievement. The differences between this study and the present study is that the study was conducted to determine Achievement of Basic Science and Technology Students with Learning Disabilities while, present will be carried out in technical colleges in Gombe state to determine the students achievement, interest and retention in Basic Electricity. The study also differ in terms of geographical location, scope of the study, sample size, population, subject area and respondents. Therefore, since the study showed the effectiveness of peer tutoring when used in Achievement of Basic Science and Technology Students with Learning Disabilities, it becomes necessary to find out if bidirectional and unidirectional peer tutoring adopted by the researcher will provide similar benefit in achievement, interest and retention of Basic Electricity student in technical colleges.

Atsumbe, *et al*. (2019) carried out a study titled: effects of scaffolding and collaborative instructional approaches on students' achievement in Basic Electronics. A quasi-experimental research design was adopted for the study. The performance of 105 Senior Secondary two (SS 2) students in Basic Electronics was obtained after being taught with scaffolding and collaborative instructional approaches using the Basic Electronics Cognitive Achievement Test (BECAT). Data collected were analyzed using mean and ANCOVA. Results revealed that a collaborative instructional approach is more effective in improving student achievement in Basic Electronics than a scaffolding instructional approach. Also, gender had no significant influence on students' achievement in Basic Electronics when taught using scaffolding and collaborative instructional approaches. It was concluded that the collaborative instructional approach is a viable teaching method for improving students' achievement in Basic Electronics. It was recommended that teachers adopt the collaborative instructional approach for teaching Basic Electronics.

However, the two studies determined the effects of collaborative instructional approaches which are bidirectional and unidirectional peer tutoring on student academic achievement. The study differ in terms of geographical location, scope of the study, sample size, population, subject area and respondents. Therefore, since the study showed the effectiveness of collaborative instructional approach for improving students' academic achievement, in Basic electricity, it becomes necessary to find out if bidirectional and unidirectional peer tutoring adopted by the researcher will provide similar benefit in improving students' academic achievement, interest and retention of Basic Electricity in technical colleges.

Agu and Samuel (2019) carried out a study titled: Comparative Effects of Peer Tutoring and Explicit instructional strategies on Science and Technical college students'

achievement and retention in Nasarawa State, Nigeria. Quasi-experimental, non-equivalent pretest, post-test, post-post-test control group design was employed for the study. The population consisted of 1,237 Science and Technical college students. The sample of the study comprised 67 Science and Technical College students purposively sampled from two intact classes randomly selected from the three Science and Technical colleges in Nasarawa State, Nigeria. Two research questions and two research hypotheses guided the study.

Science and Technical Achievement Test (STAT) were used as instrument for data collection. It reliability was determined using Kuder-Richardson formula 20 (KR20) and the reliability coefficient of 0.83 was obtained. Mean and Standard Deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance. Bonferroni Multiple Comparisons was used to determine the direction of the difference. The findings of this study revealed that Peer Tutoring and Explicit instructional strategies have significant effect on Science and Technical college students' achievement and retention.

Based on the findings of this study, it was recommended that; Science and Technical college teachers should incorporate Peer Tutoring and Explicit instructional strategies into the teaching of Science and Technical subjects.

However, the two studies determined the effects of peer tutoring on student academic achievement and retention. The differences between this study and the present study is that the study was conducted to determine the Science and Technical college students' achievement and retention in Nasarawa State while, present will be carried out in technical colleges in Gombe state to determine the students achievement, interest and retention in Basic Electricity. The studies also differ in terms of geographical location,

scope of the study, sample size, population, subject area and respondents. Therefore, since the study showed the effectiveness of peer tutoring when used in Basic Science on Science and Technical college students' achievement and retention in Nasarawa State, it becomes necessary to find out if bidirectional and unidirectional peer tutoring adopted by the researcher will provide similar benefit in achievement, interest and retention of Basic Electricity student in technical colleges.

Eze *et al*. (2020) carried out a study titled: the relative effectiveness of constructivism and metalearning teaching methods on academic achievement and retention of basic electricity among Technical College students. A quasi-experimental research design was adopted. Purposive sampling technique was used to select 108 students from four technical colleges in Anambra State. Two technical colleges each were randomly selected to experimental group one and other two technical colleges to experimental group two. Experimental group one used constructivism teaching method while the experimental group two used meta-learning teaching method.

The instrument for data collection was Basic Electricity Achievement Test (BEAT). BEAT was developed by the researchers and validated by three experts in the Faculty of Education, NnamdiAzikiwe University, Awka. Kuder Richardson 20 formula was used to determine the reliability of the instrument which yielded reliability co-efficient of 0.87. Data collected for the study were analyzed using mean for research questions and ANCOVA for null hypotheses at 0.05 level of significance. The result of the study revealed that constructivism teaching method had a significant effect on students' achievement when compared to metalearning teaching method. Also the study showed that meta-learning teaching method had a significant effect on students' retention ability.

Based on the findings, it was recommended among others that teachers of basic electricity should adopt the teaching methods that incorporate constructivism teaching method and meta-learning teaching method in teaching and learning of basic electricity in order to enhance knowledge mastery and retention among students. However, the study determined the relative effectiveness of constructivism teaching methods on academic achievement and retention of basic electricity among Technical College students, while the present study determined effects of bidirectional and unidirectional peer tutoring on student academic achievement interest and retention in technical colleges.

The differences between this study and the present study is that the study was conducted to determine the relative effectiveness of constructivism and meta learning teaching methods on academic achievement and retention of basic electricity among Technical College students, while, present will be carried out in technical colleges in Gombe state to determine the students achievement, interest and retention in Basic Electricity. The studies also differ in terms of geographical location, scope of the study, sample size, population, subject area and respondents. Therefore, since the study showed the relative effectiveness of constructivism and metalearning teaching methods on academic achievement and retention of basic electricity among Technical College students, it becomes necessary to find out if bidirectional and unidirectional peer tutoring adopted by the researcher will provide similar benefit in achievement, interest and retention of Basic Electricity student in technical colleges.

2.4 Summary of Literature Reviewed

From the various literature reviewed so far, it has been revealed that Bidirectional and Unidirectional peer tutoring techniques have added a new dimension to the teaching and learning process by emphasizing engagement and promotion of interest in learning

content, to address students diverse dispositions and learning styles. An effort has been made to review as much as possible literature related to this study. This was initiated by considering the conceptual and theoretical framework. Theories found to be most relevant were that of Social cognitive theory (SCT) of Bandura, Vygotsky's social cognitive theory, and Social Interdependence Theory were discussed about their relationship with the present study. A summary of the theoretical framework indicated that all the theories emphasize that student learn through the help of others, that the outcome of each student depends on the contribution of the others.

The conceptual framework, which aimed at emphasizing the various concept that are relevant to the study were discussed. They include the concept of peer tutoring, bidirectional peer tutoring and unidirectional peer tutoring, basic electricity in technical colleges, methods of teaching basic electricity at technical colleges, the need for change in instructional approach, student's achievement in basic electricity, student's interest in learning, retention of learning, gender and academic achievement**,** gender and academic interest**,** gender issues in technical education. The review also covered some empirical research findings on gender as it affects academic achievement, interest and retention. The review of related empirical studies gathers information on the study related to the present study. These studies were related to the present study as they dwelled on the effects of bidirectional peer tutoring technique on the academic achievement, interest of student or effects of unidirectional peer tutoring on students' achievement, interest and retention. However, many studies carried out elsewhere have shown that peer tutoring instructional approach improves students' academic achievement, interest and retention in basic electricity with non-specific interest in Bidirectional and Unidirectional peer tutoring instructional approaches. Also, none of these studies have been conducted in the technical colleges in Gombe State. Thus, the present study focused on the effective use

of instructional approaches such as Bidirectional and Unidirectional peer tutoring instructional approaches in technical colleges in Gombe State.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

This study adopted a Quasi-experimental research design. Specifically, the pre-test –post-test non-equivalent control group design was adopted for the study. Hence, an intact class was used in order not to disturb the academic programmes of schools involved in the study. The use of intact classes in a quasi-experimental design form natural clusters having similar age, height and other attributes. Besides, the true-experimental design would require assigning learners randomly to classes and also learners to different treatments which will disrupt or disorganize the normal school programme. The design was slightly modified for this study by adding a delayed post-test (retention test). The research design was symbolically represented as follows:

GROUP	**NOTATION**			
Experimental 1	Q_1	X_1	Q_2	Q_3
Experimental 2	Q_2	X_2	Q_2	Q_3

Where:

O_1: Pre-test for both experimental groups.

O_2: Post-test for both experimental groups.

Q_3: Retention test for both experimental groups.

X_1: Treatment with Bidirectional Peer-Tutoring approach

X_2: Treatment with Unidirectional Peer-Tutoring approach

3.2 Area of the Study

The study was conducted in Six technical colleges in Gombe State. Gombe State is located in the North-East geopolitical zone of Nigeria. It has a landmass area of 20,265 square kilometers and falls within the Latitude $90^0.30^{'}$ to $10^0.16^{'}$ north of the equator and

Longitude $11^0.50^{'}$ to $10^0.10$ east of Greenwich. It is also bounded by Yobe and Borno States to the North, Adamawa and Taraba State to the East, Bauchi State to the West. (Gombe State Ministry of Land and Survey, 2018). Poor performance of the graduates of electrical installation and maintenance work in Basic electricity from all the Technical Colleges in Gombe State as envisage by NABTEB examination record for the periods of 2014-2019 necessitated the choice of Gombe State as an area of the study.

3.3 Population of the Study

The targeted population for this study was 273 NTC I (207 male and 66 female) students who are taking basic electricity modules in the six State Technical Colleges in Gombe State. NTC I students' are the only group of students that can give a total representation of the population and any changes in the method of teaching may not affect their performance. Table 3.1 shows the population distribution of the students according to the schools used for the study.

Table 3.1

Population Distribution in the Study Area

S/N	SCHOOLS	MALE	FEMALE	TOTAL
1	Government Science Technical College Burendi	31	12	43
2	Government Science Technical College Gombe	40	11	50
3	Government Science Technical College Kumo	39	07	46
4	Government Science Technical College Amada	36	18	54
5	Government Science Technical College Kwami	26	13	39
6	Government Science Technical College Tula	35	05	50
	TOTAL POPULATION	**207**	**66**	**273**

Source: Gombe State Ministry of Education, statistics of students for 2020/2021 academic session.

3.4 Sample and Sampling Technique

A purposive sampling technique was used to pick four technical colleges for the study. These four technical colleges were chosen for the study because they comprised of both male and female students. Thus, the sampled population for the study was 194 NTC I Basic electricity students from the four technical colleges. Simple balloting technique was used for two technical colleges to treatment group I and the other two to treatment group II. The schools assigned to treatment group I include: Government Science Technical College Burendi and Government Science Technical College Gombe. While those assigned to treatment group II include: Government Science Technical College Kumo and Government Science Technical College Amada. Table 3.2 shows the sample population distribution in the area of study.

Table 3.2

Sample Population Distribution in the Study Area

S/N	Name of Schools	Male	Female	Total
1	Government Science Technical College Burendi	31	12	43
2	Government Science Technical College Gombe	40	11	51
3	Government Science Technical College Kumo	39	07	46
4	Government Science Technical College Amada	36	18	54
	Total	**146**	**48**	**194**

Source: Gombe State Ministry of Education, statistics of students for 2019/2020 academic session.

3.5 Instrument for Data Collection

The instruments for data collection were Basic Electricity Achievement Test (BEAT), Basic Electricity Retention Tests (BERT) as shown in (Appendix H page 166), and Basic Electricity Interest Inventory (BEII) as shown in (Appendix J page 177). (BEAT) and (BERT) consists of 60 multiple-choice items with four options. The items of the achievement and retention tests were developed by the researcher covering the topics

considered in this study. And the items are based on Bloom's taxonomy of educational objectives. A table of specification was built for the test. Based on the table of specifications, items for both BEAT and BERT were drawn. While Basic Electricity Interest Inventory (BEII), was used to collect data on student interest that are offering Basic Electricity. BEAT, BERT and BEII were developed by the researcher. The BEII consisted of 30 items structured questionnaire with four point rating scale options of Strongly Agree = 4; Agree = 3; Disagree = 2 and Strongly Disagree = 1 point respectively.

The researcher prepared two sets of lesson plans for the topics (module) selected for the study. Each set contains eight lesson plans that lasted for eight weeks and a minimum of 90 minutes duration. One set of the lesson plan was prepared based on the Bidirectional Peer-Tutoring Instructional approach to be used by the teachers assigned to experimental group I and the other set was prepared based on the Unidirectional Peer Tutoring Instructional approach to be used by the teachers assigned to experimental group II. Each Bidirectional and Unidirectional Peer Tutoring lesson plan indicates among others, the lesson, topic, specific objectives, previews knowledge, teaching aids and the instructional procedure. The instructional procedures showed details of the steps, introduction, students and teachers activities, evaluation, and summary.

3.6 Validation of the Instruments

The instruments, Basic Electricity Achievement and Retention Test (BEART), and Basic Electricity Interest Inventory (BEII) and the two sets of lesson plans were subjected to face and content validation by three experts that include two experts in electrical/electronic technology education option, Department of Industrial and Technology Education, Federal University of Technology Minna, Niger State, one expert from National Examination Council, Psychometrics Department, Niger State. The experts

were specifically requested to ascertain the suitability of the items, their relevance, language clarity, scope, the content area, and the instrument appropriateness in measuring what it was intended to and sign the validation certificate. Their corrections and suggestion assisted in making essential adjustments in the final draft of the instruments.

3.7 Reliability of Research Instrument

A trial testing exercise for BEART and BEII were carried out to determine their internal consistency. This was conducted using 20 randomly selected NTC I students from Government Technical College (GTC) Bauchi, Bauchi State. The choice of GTC, Bauchi for the trial testing exercise was because the GTC, Bauchi did not formed part of the study area. To ascertain the internal consistencies of the instruments, Kuder Richardson 21 (K-R21) was used for Basic Electricity Achievement and Retention Test (BEART). Kuder Richardson 21 (K-R21) was used for BEART and a coefficient of 0.79 was obtained as shown in appendix M, page 183, and the Cronbach Alpha reliability technique was used for obtaining the internal consistency of the BEII, a coefficient of 0.83 was obtained as shown in appendix N, page 184. The split-half technique was used on the BEART because it requires only one administration of the instrument and no time interval is involved.

3.8 Experimental Procedures

The study was conducted during the normal school periods. The usual timetable for the contact periods of the school was followed. The basic electric teachers in the schools were used as research assistants. They were trained on how to use lesson plans as shown in Appendix K, page 179 for the training manual. Out of the four (4) schools involved in the study, two schools was randomly assigned to treatment group A (bidirectional peer tutoring), while the other two was assigned to treatment group B (unidirectional peer tutoring). Group A were taught using bidirectional peer tutoring, while group B were

taught using unidirectional peer tutoring. The treatments was made up of 8 lessons to be conducted for 8 weeks. Each group was met once a week for 90 minutes (Double period).

The two groups were subjected to pre-test (BEAT and BEII) before the treatment which was conducted by the teachers teaching these groups. The answer scripts were marked using the marking scheme as shown in Appendix I page 176) to obtain students' scores on achievement and interest before treatment. After eight weeks of treatment, a post-test (BEAT and BEII) were administered a week after the treatment to obtain students' scores in achievement and interest in basic electricity. Furthermore, after two weeks of administering the instrument, that is post-test, a BEAT was reshuffle as BERT and was given as a test of retention to the groups and the scores obtained from both groups were compared to determine their mean retention scores in basic electricity.

3.9 Control of Extraneous Variables

Experimental Bias: To reduce experimental bias, the regular subject class teacher in the participating school were used to teach their students. Hence, the researcher was not directly involved in administering the research instruments.

Hawthorne effect: Hawthorne effect is a situation where the performance of the research subject is affected because the students are conscious of the fact that they are involved in an experiment. To reduce this problem, the researcher used the normal class teachers in both experimental groups.

Pretest and Posttest sensitization: Since the same instrument was used for both pre-test and post-test for the measurement of Basic Electricity students' cognitive achievement. It was very easy for the students to get familiar with the test instrument and hence bringing error into the study. To control this pre-test sensitization therefore, the researcher

i. Withdraw all the instrument items from the students and the classroom teachers after the pre-testing.

ii. Restructure or reshuffle the options in each test items in the pretest before using it as posttest.

Initial group difference: The researcher checked the issue of initial group difference through the application of analysis of covariance (ANCOVA) since the study was pre-test, posttest, non-equivalent control group design.

3.10 Administration of the Instrument

The regular electrical and electronic trade teachers administered the pretest on their students in the two groups. After the pretest, treatment were administered to the subjects by their regular teachers. At the end of the eight weeks of teaching, a posttest were administered to both experimental groups. The posttest were administered, supervised, and graded by the teachers that teaches the groups using the scoring guides developed by the researcher. The scores of the experimental groups in both pretest and posttest were recorded and compared to check if there was a significant difference in the achievement and retention of the groups.

3.11 Method of Data Analysis

Data collected for the study, were analysed using Statistical Package for Social Science (SPSS) version 23.0. Descriptive and inferential statistics were used to analyse the data. The Descriptive statistics used in analysing the data was mean statistics that answered research questions. While inferential statistics was employed for the study using the General Linear Model (univariate) to perform the Analysis of Covariance (ANCOVA). The null hypotheses were tested using Analysis of Covariance (ANCOVA) at a 0.05 level of significance. Since students in their intact classes participated in the experiment,

ANCOVA was considered appropriate for the data analyses. The use of ANCOVA was, to control the errors of the initial non-equivalence arising from the use of intact classes as subjects of the study. The decision on the null hypotheses formulated were based on comparing the significant value with ($P < .05$) level of significance, that is where the significant value is less than ($P < .05$) it was rejected, while equal or greater than ($P < .05$) level of significant the hypothesis was upheld or accepted.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Research Question One

What is the effect of bidirectional and unidirectional peer tutoring instructional approaches on the students' achievement in Basic electricity?

The data for answering Research Question one are presented in table 4.1

Table 4.1
Mean of Pre-test and Post-test Achievement Scores of Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

Groups	N	Pre-test Mean	Post-test Mean	Mean Gain
Experimental Group I (B PT)	94	36.59	67.43	30.84
Experimental Group II (UPT)	100	33.03	63.67	30.64

The data presented in Table 4.1 shows that the experimental group I taught with Bidirectional Peer Tutoring Approach had a mean score of 36.59 in the pretest and a mean score of 67.43 in the posttest making a pretest, posttest mean gain in experimental group I to be 30.84. the experimental group II taught with Unidirectional Peer Tutoring Approach had a mean score of 33.03 in the pretest and a mean score of 63.67 in the posttest making a pretest, posttest mean gain in experimental group II to be 30.64. With this result, the students in the experimental group I taught with Bidirectional Peer Tutoring Approach performed better in the achievement test than the students in the experimental group II taught with Unidirectional Peer Tutoring Approach. Hence, bidirectional peer tutoring approach is slightly effective than the unidirectional peer tutoring approach on students achievement in Basic Electricity.

4.2 Research Question Two

What is the effect of bidirectional and unidirectional peer tutoring instructional approaches on the students' interest in Basic electricity?

The data for answering Research Question two are presented in table 4.2

Table 4.2
Mean of Pre-test and Post-test Interest Scores of Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

Groups	N	Pre-test Mean	Post-test Mean	Mean Gain
Experimental Group I (BPT)	94	32.62	68.09	35.47
Experimental Group II (UPT)	100	30.96	63.77	32.81

Table 4.2 shows that, the experimental group I had a mean score of 32.62 in the pretest and a mean score of 68.09 in the posttest making a pretest, posttest mean gain in experimental group I to be 35.47. The experimental group II had a mean score of 30.96 in the pretest and a posttest mean of 63.77 with a pretest, posttest mean gain of 32.81. With this result, the experimental group I interest is higher than the interest of the students in the experimental group II. Therefore, bidirectional peer tutoring approach is more effective than the unidirectional peer tutoring approach in stimulating students' interest in Basic Electricity.

4.3 Research Question Three

What is the effect of bidirectional and unidirectional peer tutoring instructional approaches on the students' learning retention in Basic electricity?

The data for answering Research Question three are presented in table 4.3

Table 4.3

Mean of Post-test and Retention Scores of Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

Groups	N	Post-test Mean	Delay-test Mean	Mean diff
Experimental Group I (BPT)	94	67.43	64.53	2.90
Experimental Group II (UPT)	100	63.67	60.85	2.82

The data presented in Table 4.3 shows that the experimental group I taught with Bidirectional Peer Tutoring Approach had a mean score of 67.43 in the posttest and a mean delay score of 64.53 in the retention test making a posttest, retention mean difference in experimental group I to be 2.90. the experimental group II taught with Unidirectional Peer Tutoring Approach had a mean score of 63.67 in the posttest and a mean delay score of 60.85 in the posttest making a posttest, retention mean difference in experimental group II to be 2.82. With this result, the students in the experimental group I taught with Bidirectional Peer Tutoring Approach have more retention rate than the students in the experimental group II taught with Unidirectional Peer Tutoring Approach. Hence, bidirectional peer tutoring approach is slightly effective than the unidirectional peer tutoring approach on students learning retention in Basic Electricity.

4.4 Research Question Four

What is the effect of gender on student achievement in Basic electricity when taught using bidirectional and unidirectional peer tutoring instructional approaches?

The data for answering Research Question four are presented in table 4.4

Table 4.4

Mean of Pre-test and Post-test Achievement Scores of male and female Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

	Bidirectional				Unidirectional		
Gender	N	Pre-test Mean	post-test Mean	Mean Gain	N	Pre-test Mean	post-test Mean	Mean Gain
Male	71	34.76	68.09	33.33	75	30.96	65.46	34.50
Female	23	34.73	63.77	29.04	25	32.62	65.58	32.96

The data presented in Table 4.4 shows that male students taught Basic electricity with bidirectional peer tutoring instructional approach had a mean score of 34.76 in the pretest and a mean score 68.09 in the posttest making a pretest, posttest mean gain in the male students taught with bidirectional peer tutoring instructional approach to be 33.33. Meanwhile, female students taught Basic electricity with bidirectional peer tutoring instructional approach had a mean score of 34.73 in the pretest and a posttest mean of 63.77 with a pretest, posttest mean gain of 29.04. Also, male students taught Basic electricity with unidirectional peer tutoring instructional approach had a mean score of 30.96 in the pretest and a mean score 65.46 in the posttest making a pretest, posttest mean gain in the male students taught with unidirectional peer tutoring instructional approach to be 34.50. Meanwhile, female students taught Basic electricity with unidirectional peer tutoring instructional approach had a mean score of 32.62 in the pretest and a posttest mean of 65.58 with a pretest, posttest mean gain of 32.96. With these results male students taught Basic electricity using bidirectional peer tutoring instructional approach had higher mean gain scores than female students in the Achievement Test. Thus, there is an effect attributable to gender on the achievement of students taught Basic electricity.

4.5 Research Question Five

What is the effect of gender on students' interest in Basic electricity when taught using bidirectional and unidirectional peer tutoring instructional approaches?

The data for answering Research Question five are presented in table 4.5

Table 4.5
Mean of Pre-test and Post-test Interest Scores of male and female Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

	Bidirectional				Unidirectional		
Gender	N	Pre-test Mean	Post-test Mean	Mean Gain	N	Pre-test Mean	Post-test Mean	Mean Gain
Male	71	31.61	65.70	34.09	75	32.62	68.09	35.47
Female	23	32.23	66.40	34.17	25	30.96	63.77	32.81

The data presented in Table 4.5 shows that male students taught Basic electricity with bidirectional peer tutoring instructional approach had a mean score of 31.61 in the pretest and a mean score 65.70 in the posttest making a pretest, posttest mean gain in the male students taught with bidirectional peer tutoring instructional approach to be 34.09. Meanwhile, female students taught Basic electricity with bidirectional peer tutoring instructional approach had a mean score of 32.23 in the pretest and a posttest mean of 66.40 with a pretest, posttest mean gain of 34.17. Also, male students taught Basic electricity with unidirectional peer tutoring instructional approach had a mean score of 32.62 in the pretest and a mean score 68.09 in the posttest making a pretest, posttest mean gain in the male students taught with unidirectional peer tutoring instructional approach to be 35.47. Meanwhile, female students taught Basic electricity with unidirectional peer tutoring instructional approach had a mean score of 30.96 in the pretest and a posttest mean of 63.77 with a pretest, posttest mean gain of 32.81. With these results female students taught Basic electricity using bidirectional peer tutoring instructional approach

had higher mean gain scores than male. While male students taught Basic electricity using unidirectional peer tutoring instructional approach had higher mean gain scores than female. Thus, there is an effect attributable to gender on the interest of students taught Basic electricity.

4.6 Research Question Six

What is the effect of gender on students learning retention in Basic electricity when taught using bidirectional and unidirectional peer tutoring instructional approaches?

The data for answering Research Question six are presented in table 4.6

Table 4.6
Mean of Post-test and Retention Scores of male and female Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

	Bidirectional				Unidirectional		
	Post-test	Delay Post-test	Mean Diff.		Post-test	Delay posttest	Mean Diff.
Gender	N	Mean	Mean	N	Mean	Mean	
Male	71	65.46	62.67	2.79	75	67.43	64.53	2.90
Female	23	65.58	62.52	3.06	25	63.67	60.85	2.82

The data presented in Table 4.6 shows that male students taught Basic electricity with bidirectional peer tutoring instructional approach had a mean score of 65.46 in the posttest and a mean score 62.67 in the delay posttest making a posttest, delay posttest mean difference in the male students taught with bidirectional peer tutoring instructional approach to be 2.79. Meanwhile, female students taught Basic electricity with bidirectional peer tutoring instructional approach had a mean score of 65.58 in the posttest and a delay posttest mean of 62.52 with a posttest, delay posttest mean difference of 3.06. Also, male students taught Basic electricity with unidirectional peer tutoring instructional approach had a mean score of 67.43 in the posttest and a mean score 64.53 in the delay posttest making a posttest, delay posttest mean difference in the male students taught with

unidirectional peer tutoring instructional approach to be 2.90. Meanwhile, female students taught Basic electricity with unidirectional peer tutoring instructional approach had a mean score of 63.67 in the posttest and a delay posttest mean of 60.85 with a posttest, delay posttest mean difference of 2.82. With these results female students taught Basic electricity using bidirectional peer tutoring instructional approach had higher retention mean difference than male students. While male students taught Basic electricity using unidirectional peer tutoring instructional approach had higher retention mean difference than female students. Thus, there is an effect attributable to gender on the students' learning retention taught Basic electricity.

4.7 Hypothesis One

There is no significant difference between the mean achievement scores of students taught Basic electricity using bidirectional peer-tutoring instruction and those taught using unidirectional peer tutoring instructional approaches.

The data for testing Research hypothesis one is presented in table 4.7

Table 4.7
Analysis of Covariance for the Test of Significance Difference between the Achievement Scores of Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5863.468[a]	2	2931.734	410.225	.000
Intercept	8183.906	1	8183.906	1145.138	.000
Pretest	5180.078	1	5180.078	724.826	.000
Group	29.806	1	29.806	4.171	.043
Error	1365.011	191	7.147		
Total	839275.000	194			
Corrected Total	7228.479	193			

a. R Squared = .811 (Adjusted R Squared = .809)

The data presented in Table 4.7 shows F-calculated value for testing the significance difference between the achievement scores of students taught Basic electricity using BPT

instructional approach and those taught with UPT instructional approach. The F-calculated value of 4.171 was obtained with associated exact probability value of .043. Since the associated probability of 0.043 was less than 0.05 set as a level of significance, the null hypothesis which stated that there is no significance difference between the mean achievement scores of students taught Basic electricity using bidirectional peer-tutoring instruction and those taught using unidirectional peer tutoring instructional approaches is rejected. Hence, there is significant difference between the mean achievement scores of students taught Basic electricity using bidirectional peer-tutoring instruction and those taught using unidirectional peer tutoring instructional approach.

4.8 Hypothesis Two

There is no significant difference between the mean interest scores of students taught Basic electricity using bidirectional peer-tutoring instruction and those taught using unidirectional peer tutoring instructional approaches.

The data for testing Research hypothesis two is presented in table 4.8

Table 4.8
Analysis of Covariance for the Test of Significance Difference between the Interest Scores of Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5703.365[a]	2	2851.683	341.027	.000
Intercept	4844.402	1	4844.402	579.332	.000
Pretest	4796.698	1	4796.698	573.628	.000
Group	323.471	1	323.471	38.683	.000
Error	1597.150	191	8.362		
Total	848936.000	194			
Corrected Total	7300.515	193			

a. R Squared = .781 (Adjusted R Squared = .779)

Table 4.8 shows the F-calculated value for testing the significance difference between the interest scores of students taught Basic electricity using BPT instructional approach and

those taught with UPT instructional approach. The F-calculated value of 38.683 was obtained with associated exact probability value of .000. Since the associated probability of 0.000 was less than 0.05 set as a level of significance, the null hypothesis which stated that there is no significance difference between the mean interest scores of students taught Basic electricity using BPT instruction and those taught using UPT instructional approach is rejected. Hence, there is significant difference between the mean interest scores of students taught Basic electricity using bidirectional peer-tutoring instruction and those taught using unidirectional peer tutoring instructional approach.

4.9 Hypothesis Three

There is no significant difference between the mean retention scores of students taught Basic electricity using bidirectional peer-tutoring instruction and those taught using unidirectional peer tutoring instructional approaches.

The data for testing Research hypothesis three is presented in table 4.9

Table 4.9
Analysis of Covariance for the Test of Significance Difference between the Retention Scores of Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5270.470[a]	2	2635.235	327.147	.000
Intercept	7642.285	1	7642.285	948.738	.000
Pretest	4613.609	1	4613.609	572.748	.000
Group	36.895	1	36.895	4.580	.034
Error	1538.546	191	8.055		
Total	767875.000	194			
Corrected Total	6809.015	193			

a. R Squared = .774 (Adjusted R Squared = .772)

Table 4.9 shows the F-calculated value for testing the significance difference between the retention scores of students taught B.E using BPT instructional approach and those taught with UPT instructional approach. The F-calculated value of 4.580 was obtained with

associated exact probability value of .034. Since the associated probability of 0.034 was less than 0.05 set as a level of significance, the null hypothesis which stated that there is no significant difference between the mean retention scores of students taught Basic electricity using BPT instruction and those taught using UPT instructional approach is rejected. Hence, there is significant difference between the mean retention scores of students taught Basic electricity using bidirectional peer-tutoring instruction and those taught using unidirectional peer tutoring instructional approach.

4.10 Hypothesis Four

There is no significant difference between the mean achievement scores of male and female students taught Basic electricity using bidirectional peer-tutoring instructional approaches.

The data for testing Research hypothesis four is presented in table 4.10

Table 4.10
Analysis of Covariance for the Test of Significance Difference between the Achievement Male and Female Scores of Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5834.483[a]	2	2917.241	399.709	.000
Intercept	8483.103	1	8483.103	1162.322	.000
Pretest	5833.923	1	5833.923	799.341	.000
Gender	.820	1	.820	.112	.738
Error	1393.997	191	7.298		
Total	839275.000	194			
Corrected Total	7228.479	193			

a. R Squared = .807 (Adjusted R Squared = .805)

Table 4.10 shows the F-calculated value for testing the significance difference between the achievement scores of students taught Basic electricity using BPT instructional approach and those taught with UPT instructional approach. The F-calculated value of 0.112 was obtained with associated exact probability value of .738. Since the associated

probability of 0.738 was greater than 0.05 set as a level of significance, the null hypothesis which stated that there is no significant difference between the mean achievement scores of male and female students taught Basic electricity using bidirectional and unidirectional peer-tutoring instructional approaches is accepted. Hence, there is no significant interaction effect of treatments given to students and their gender with respect to their mean scores on the Basic electricity Achievement Test.

4.11 Hypothesis Five

There is no significant difference between the mean interest scores of male and female students taught Basic electricity using bidirectional peer-tutoring instructional approaches.

The data for testing Research hypothesis five is presented in table 4.11

Table 4.11
Analysis of Covariance for the Test of Significance Difference between the Interest Scores of Male and Female Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5379.949[a]	2	2689.975	267.518	.000
Intercept	4471.195	1	4471.195	444.660	.000
Pretest	5362.043	1	5362.043	533.254	.000
Gender	.055	1	.055	.005	.941
Error	1920.566	191	10.055		
Total	848936.000	194			
Corrected Total	7300.515	193			

a. R Squared = .737 (Adjusted R Squared = .734)

The data presented in Table 4.11 shows F-calculated value for testing the significance difference in the interest inventory of students taught Basic electricity using BPT instructional approach and those taught with UPT instructional approach. The F-calculated value of 0.005 was obtained with associated exact probability value of .941. Since the associated probability of 0.941 was greater than 0.05 set as a level of

significance, the null hypothesis which stated that there is no significant difference between the mean interest scores of male and female students taught basic electricity using bidirectional and unidirectional peer-tutoring instructional approaches is accepted. Hence, there is no significant interaction effect of treatments given to students and their gender with respect to their mean scores on Basic electricity Interest Inventory.

4.12 Hypothesis Six

There is no significant difference between the mean retention scores of male and female students taught Basic electricity using bidirectional peer-tutoring instructional approaches.

The data for testing Research hypothesis six is presented in table 4.12

Table 4.12
Analysis of Covariance for the Test of Significance Difference between the Retention Scores of Male and Female Students taught Basic Electricity using Bidirectional and Unidirectional Peer tutoring Instructional approaches

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5234.144[a]	2	2617.072	317.398	.000
Intercept	7851.060	1	7851.060	952.175	.000
Pretest	5233.327	1	5233.327	634.697	.000
Gender	.569	1	.569	.069	.793
Error	1574.871	191	8.245		
Total	767875.000	194			
Corrected Total	6809.015	193			

a. R Squared = .769 (Adjusted R Squared = .766)

The data presented in Table 4.12 shows F-calculated value for testing the significance difference between the retention scores of students taught Basic electricity using BPT instructional approach and those taught with UPT instructional approach. The F-calculated value of 0.069 was obtained with associated exact probability value of .793. Since the associated probability of 0.793 was greater than 0.05 set as a level of

significance, the null hypothesis which stated that there is no significant difference between the mean achievement scores of students taught Basic electricity using BPT instruction and those taught using UPT instructional approach is accepted. Hence, there is no significant interaction effect of treatments given to students and their gender with respect to their mean scores on the Basic Electricity Retention Test.

4.13 Findings of the Study

The following findings emerged from the study based on the data collected and analyzed and hypotheses tested

1. Bidirectional peer tutoring instructional approach is slightly effective than the unidirectional peer tutoring instructional approach on student's achievement in Basic electricity.
2. Bidirectional peer tutoring approach is slightly effective than the unidirectional peer tutoring approach in stimulating students' interest in Basic Electricity.
3. Bidirectional peer tutoring approach is slightly effective than the unidirectional peer tutoring approach on students learning retention in Basic Electricity.
4. It was found that there is an effect of gender on the achievement of students taught Basic electricity using bidirectional peer tutoring approach in favour of male students.
5. It was found that there is an effect of gender on the interest of students taught Basic electricity using bidirectional peer tutoring approach in favour of male students.
6. There was effect of gender on students learning retention taught Basic electricity using bidirectional peer tutoring approach in favour of female students.

7. There was a significant difference between the mean achievement scores of students taught Basic electricity using BPT instruction and those taught using UPT instructional approach.
8. There was a significant difference between the mean interest scores of students taught basic electricity using BPT instructional approach and UPT instructional approaches.
9. There was significant difference between the retention scores of students taught basic electricity using BPT instructional approach and UPT instructional approaches.
10. There was no significant interaction effect of treatments given to students and their gender with respect to their mean scores on the Basic electricity Achievement Test.
11. There was no significant interaction effect of treatments given to students and their gender with respect to their mean scores on Basic electricity Interest Inventory.
12. There was no significant interaction effect of treatments given to students and their gender with respect to their mean scores on the Basic electricity Retention Test.

4.14 Discussion of Findings

The finding in table 4.1 on the effects of bidirectional and unidirectional peer tutoring instructional approaches on students' achievement in basic electricity in technical colleges in Gombe State Nigeria revealed that, BPT and UPT instructional approaches are effective for improving students' academic achievement. However, the BPT instructional approach was more effective than the UPT instructional approach. Analysis of covariance was used to test hypothesis one Table 4.7. This indicated that there was a

significant difference between the mean achievement scores of students taught Basic electricity using BPT instruction and those taught with the UPT instructional approach, in favour of the BPT instructional approach. This confirmed that the difference between the BPT instructional approach and the UPT instructional approach was statistical significant.

These imply that BPT and UPT instructional approaches are effective for teaching Basic electricity. However, the BPT instructional approach is more effective than the UPT instructional approach. This finding is similar to that of Esteve (2015) in his study on investigation of the effect of Bidirectional peer tutoring and treatment integrity of elementary school students which revealed significant improvement in the achievement of students after being exposed to BPT instructional approach. Similarly, the finding of this study is supported by the findings of Evans (2010) that found significant improvement in the students' academic achievement and peer interaction. Meanwhile, the improvement in the students' achievement could be attributed to the overwhelming characteristics attributed to bidirectional peer-tutoring instruction over other methods. Since BPT instruction used skills such as predicting, clarifying, questioning and summarizing which potentially help students' to understand what they read, it could as well enhance their achievement in basic electricity.

This finding is in agreement with that of Agu and Samuel (2018) the study found that Peer tutoring strategies enhances students' achievement and retention. The increase in students' achievement and retention scores could probably be because they were excited to have acted like teachers and giving opportunities to teach and learn among their peer groups. Apparently, teaching, instructing, demonstrating instructions like their teachers promoted their interest to learn. The finding relates to the findings of Ene (2012) who

reported that students taught with the learners' centred instruction such as constructivist model based learning showed higher degree of achievement than students' taught with the conventional teaching method.

Furthermore, findings on the test of significant difference among the achievement scores of students taught basic electricity using BPT instructional approach and those taught with UPT instructional approach revealed statistically significant difference between the achievement mean scores of students taught basic electricity using BPT instructional approach and those taught with UPT instructional approach. This finding is in consonance with that of Irfan *et al*. (2018) who revealed that peer tutoring enhanced the academic achievement of students in the experimental group significantly as compared to the control group. Hence, it was an effective method of instruction for teaching biology and other science subjects at secondary level. Evidently, the treatment students in the BPT group exposed to be responsible for the significant difference in the achievement mean score of students between the two groups. And the most effective form of the peer tutoring was a bidirectional method where the students reverse roles of tutor and tutee were used regularly. The research indicated that, when students are required to explain their thought process in such a way that the other students will understand, they get a deeper understanding of the concept themselves which better academic achievement.

Furthermore, Kurt and Becker (2014) reported that there was no significant difference in achievement mean scores between Thailand students exposed to conventional teaching method and constructivist teaching strategy in vocational programmes. However, the no significant difference could be attributed to the effectiveness of the conventional teaching method used.

The finding in table 4.2 on the effects of bidirectional and unidirectional peer tutoring instructional approaches on students' interest in basic electricity in technical colleges in Gombe State Nigeria revealed that, BPT and UPT instructional approaches are effective for improving students' interest inventory. However, the BPT instructional approach was more effective than the UPT instructional approach. Analysis of covariance was used to test hypothesis two Table 4.8. This indicated that students taught basic electricity using BPT instructional approach obtained higher interest mean scores than the students taught with UPT instructional approach in the basic electricity interest inventory. The finding is in conformity with that of Akanwa and Ovute (2014) who observed that, the constructivist group indicated a higher positive mean interest scores in their favour. Furthermore, Uroko (2010) holds a similar view concerning the finding, confirmed that students' taught using BPT strategy had a higher mean interest rating than those in the conventional teaching method. Since Peer tutoring instructional approaches are highly learners-centred learning strategy on the problem solving, and places the learners the responsibility of learning directly on the students, it potentially enhance and stimulate students' interest and motivation.

Furthermore, findings on the test of significant difference between the interest mean scores of students taught basic electricity using BPT instructional approach and those taught with UPT instructional approach revealed that the F-calculated value for the effect of instructions on the interest of students taught basic electricity using BPT instructional approach and those taught with UPT instructional approach was statistically significant. Evidently, the treatment enjoyed by the students in the BPT instructional approach is responsible for the significant difference in the interest mean score of students between the two groups. The finding is in conformity with the findings of Eze *et al.* (2019) who also reported a similar findings of statistical significant difference in the interest mean

scores of students taught map work using scale models and those taught using conventional teaching methods in his study titled: effect of the use of scale models on academic achievement and interest of students in map-work.

Findings on the effects of bidirectional and unidirectional peer tutoring instructional approaches on students' retention in basic electricity in technical colleges in Gombe State Nigeria revealed that, students taught basic electricity using BPT instructional approach obtained higher retention mean scores than the students taught with UPT instructional approach in the basic electricity retention test. The finding is in line with the findings of Choudhury (2006) who carried out a study on the use of BPT instruction in an environmental control system course at undergraduate level which revealed that students in the experimental group obtained higher retention mean scores in the retention test than those in the control group. Meanwhile, the improvement in the student's cognitive retention could be attributed to the interaction with constructivist model in the instruction by the students before the posttest. In the same vein, Agu and Samuel (2018) reported a related findings that there was a significant difference between the retention scores of science and technical college students exposed to peer tutoring and explicit instructional strategies in favors of the peer tutoring instructional group. In essence, retention of knowledge increases by using BPT instructional approach.

Furthermore, the summary of ANCOVA for the test of significant difference between the retention mean scores of students taught basic electricity using BPT instructional approach and those taught with UPT instructional approach shows that the F-calculated value for the effect of instructions on the knowledge retention of students taught basic electricity using BPT instructional approach and those taught with UPT instructional approach indicated that there was a statistically significant difference between the

retention mean score of students taught basic electricity using BPT instructional approach and those taught with UPT instructional approach. Evidently, the treatment enjoyed by the students in the BPT instructional approach is responsible for the significant difference in the retention mean score of students between the two groups. The finding is similar to the finding of Agu and Samuel (2018) that revealed significant difference between the retention scores of science and technical college students exposed to peer tutoring and explicit instructional strategies in favors of the peer tutoring instructional group. The finding is in line with the findings of Udogwu and Njeleta (2010) in their work on the effect of model-based constructivist instruction on student's conceptual change and retention in chemistry at senior secondary school level which revealed significant differences in the retention mean score of students taught chemistry with model-based constructivist instruction and those taught using conventional teaching method.

The study upheld the hypothesis that states there is no significant difference in computer studies academic achievement between male and female students taught using bidirectional peer tutoring. Bidirectional peer tutoring instructional approach had no gender bias with respect to improving students' academic achievement. This showed that, peer tutoring did not favour male over female or vice-versa. This is in line with similar studies by Uwameiye and Aduwa-Ogiegbean (2016) who reported no significant difference in the academic achievement in prevocational subjects and sciences of both male and female students exposed to peer tutoring. However, this finding is at variance with Nduji and Madu (2020) who reported a significant difference in the academic performance of male and female students when exposed to a peer tutoring instructional approach.

Findings on the effects of bidirectional and unidirectional peer tutoring instructional approaches on students' achievement in basic electricity in technical colleges in Gombe State Nigeria revealed that, there was no significant difference between the mean achievement scores of male and female students taught Basic electricity using bidirectional peer-tutoring instructional approaches. Data in table 10 indicated that gender differences were not significant in students' achievement mean scores of male and female students, since the p-value of 0.112 and 0.738 for the two table respectively were greater than 0.05 level of significance. This implies that significant difference does not exist between the retention mean scores of male and female students' taught basic electricity using BPT instructional approach and those taught using UPT instructional approach. The finding is in agreement with the findings of Abdulraheem *et al.* (2017) whose study revealed that peer tutoring instructional strategy had no gender bias in terms of improving students' academic achievement.

Findings on the effects of bidirectional and unidirectional peer tutoring instructional approaches on students' interest in basic electricity in technical colleges in Gombe State Nigeria revealed that, there was no significant difference between the mean interest scores of male and female students taught Basic electricity using bidirectional peer-tutoring instructional approaches. Data in table 11 indicated that gender differences were not significant in students' achievement mean scores of male and female students, since the p-value of 0.005 and 0.941 for the two table respectively were greater than 0.05 level of significance. This implies that significant difference does not exist between the interest mean scores of male and female students' taught basic electricity using BPT instructional approach and those taught using UPT instructional approach. The finding is in agreement with the findings of Yusuf *et al.* (2012) which reported that gender has no significant effect on students' interest ability.

Findings on the effects of bidirectional and unidirectional peer tutoring instructional approaches on students' retention in basic electricity in technical colleges in Gombe State Nigeria revealed that, there was no significant difference between the mean retention scores of male and female students taught Basic electricity using bidirectional peer-tutoring instructional approaches. Data in table 12 indicated that gender differences were not significant in students' retention mean scores of male and female students, since the p-value of 0.693 and 0.793 for the two table respectively were greater than 0.05 level of significance. This implies that significant difference does not exist between the retention mean scores of male and female students' taught basic electricity using BPT instructional approach and those taught using UPT instructional approach. The finding is in agreement with the findings of Yusuf *et al.* (2012) which reported that gender has no significant effect on students' retention ability. The finding is in disagreement with the findings of Owodunni and Ogundola (2018) which revealed that there is significant difference in retention ability of male and female students. The disagreement with the present study could be as a result of students' disposition to learn. Both male and female students had equal opportunity to participate actively.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Based on the findings of the study, it was concluded that both bidirectional and unidirectional peer tutoring instructional approaches are effective for improving students' academic achievement, interest and retention in basic electricity in technical colleges but bidirectional peer tutoring instructional approach is more effective for enhancing students' academic achievement and interest level of technical college students in basic electricity. Also, there was no significant difference in the mean achievement, interest and retention scores of male and female students in the teaching of basic electricity in technical colleges. The implication of the finding is that, the adoption of peer tutoring instructional approaches hold the potential to enhance students' academic achievement, interest and retention in basic electricity. Nevertheless, the findings are limited to the contents of basic electricity at technical colleges in Nigeria. Therefore, it is concluded that, bidirectional peer tutoring instructional approach had positive effects on students' academic achievement, interest and retention in basic electricity.

5.2 Recommendations

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

1. Basic electricity teachers should adopt the use of peer tutoring instructional approaches to enhance students' academic achievement, interest and retention in basic electricity.
2. Basic electricity students should also embrace teaching and learning through the use of peer tutoring instructional approaches in order to enhance their academic achievement, interest and retention.

3. Since gender is not a significant factor in students' academic achievement, interest and retention in basic electricity, emphasis should therefore be on adopting the teaching method that incorporates peer tutoring instructional approaches in the teaching of basic electricity in order to enhance their academic achievement, interest and retention.
4. Technical college teachers should be sensitized on the efficacy of peer tutoring instructional approaches through conference, seminars and workshops.
5. Relevant government agencies and professional bodies should sponsor further research on the effectiveness of peer tutoring instructional approaches in other content areas not covered by this study.

5.3 Suggestion for Further Research

Based on the findings of this study, the following suggestions were made for further research:

1. A similar study to determine the effect of bidirectional peer-tutoring in other vocational areas such as motor vehicle mechanics work, building construction, electronics work, metalwork and woodwork should be carried out.
2. Effect of bidirectional and unidirectional peer-tutoring instructional approaches on student's psychomotor achievement and retention in Electrical Installation and Maintenance work at technical colleges in Nigeria.
3. A replication of the study should be carried out to cover a wider geographical area and other variables that are not covered in this study.

5.4 Contribution to Knowledge

The study has empirically established the effects of bidirectional and unidirectional peer tutoring instructional approaches on students' achievement, interest and retention of Basic

electricity in technical colleges in Gombe State, Nigeria. Hence, the study filled the gap by providing empirical evidence on the effectiveness of both BPT and UPT instructional approaches which proved that, BPT instructional approach was an effective instructional approach that is powerful in improving students' achievement, interest and retention in Basic electricity and is capable of creating a viable and interactive learning environment that support students' active involvement in the learning process.

REFERENCES

AbdulRaheem, Y., Yusuf, H. T., & Odutayo, A. O. (2017). Effect of peer tutoring on students' academic performance in economics in Illorin South, Nigeria. *Journal of Peer Learning, 10*(2), 95-102.

Abdu-Raheem, B. O. (2018). Gender differences and students' academic achievement and retention in social studies among Junior Secondary Schools in Ekiti State, Nigeria. *European Journal of Education Studies, 4*(1), 155-161.

Adam, J. (2019). Pearson product-moment correlation. Retrieved October 13th, 2020, from: https://explorable.com/pearson-product-moment-correlation.

Adekunle, A. A. (2017). Development and validation of auto-mechanic's intelligent tutor for teaching auto-mechanic's concept in technical colleges. *Ph.D. thesis*, Department of Vocational Teacher Education, University of Nigeria, Nsukka.

Adigun, J., Onihunwa, J., Irunokhai, E., Sada, Y., & Adesina, O. (2019). Effect of gender on students' academic performance in computer studies in secondary schools in New Bussa, Borgu Local Government of Niger State. *Journal of Education and Practice, 6*(33), 1-7.

Agu, P. A., & Samuel, R. I. (2018). Effect of Peer Tutoring Instructional Strategy on Achievement of Basic Science and Technology Students with Learning Disabilities in Nasarawa State, Nigeria. *East African Scholars Journal of Education, Humanities and Literature, 1*(2), 47-54.

Agu, P. A., & Samuel, R. I. (2019). Comparative Effect of Peer Tutoring and Explicit Instructional Strategies on Science and Technical College Students' Achievement and Retention in Nasarawa State, Nigeria. *International Journal of Research-Granthaalayah, 7*(10), 390-399.

Ahmed, A. K. (2018). Teacher-centered versus learner-centered teaching style. *Journal of Global Business Management, 9*(1), 22-34.

Ahmed, O. Q. (2016). The effect of using the constructivist learning model in teaching science on the achievement and scientific thinking of 8th Grade students. *International Journal of Education Studies, 9*(7), 179-196.

Akamobi, O. G. (2019). Comparative effectiveness of constructivism and meta-learning teaching methods on students' academic achievement and retention in basic electricity in Technical colleges. *Unpublished PhD thesis,* Faculty of Education, Nnamdi Azikiwe University, Awka.

Akanwa, N. U., & Ovute, A. O. (2014). The effect of constructivist teaching models on SSS physics student's achievement and interest. *IDSR Journal of Research & Method in Education, 4*(1), 35-38.

Ali, A. (2014). The Effect of Inquiry-based Learning Method on Students' Academic Achievement in Science Course. *Universal Journal of Educational Research, 2*(1), 37-41.

Amogne, A. E. (2015). Analysis of gender disparity in the regional examination: Case of Dessie Town; Ethiopia. *Basic Research Journal of Education Research and Review, 4*(2), 29-36.

Antherson, J. S. (2013). Learning and teaching intelligent. Retrieved on February, 20th 2017 from http://www.dma.Ac.UK/Jamies/learningintelligence.htm.

Arul, A. S., & Vimala, A. (2012). School environment and academic achievement of standard ix students. *Journal of Education and Instructional Studies in the World, 2*(3), 2146-2163.

Atsumbe, B. N., Owodunni, S. O., Raymond, E., & Uduafemhe, M. (2019). Effects of scaffolding and collaborative instructional approaches on students' achievement in Basic Electronics. *EURASIA Journal of Mathematics, Science and Technology Education, 14*(8), 2-17.

Baldwin, J. M. (1911). *Thought and things or genetic logic*. New York: Macmillan.

Bandura, A. (1977). *Social learning theory*. Engle wood. Gifts. NJ Prentice Hall.

Bishop, C. F., Caston, M., & King, C. A. (2014). Learner-centered environments: Creating effective strategies based on student attitudes and faculty reflection. *Journal of the Scholarship of Teaching & Learning*, *14*(3), 46-63.

Blumberg, P. (2015). How critical reflection benefits faculty as they implement learner-centered teaching. *New Directions for Teaching & Learning*, *1*(144), 87-97.

Cervantes, C. M., Lieberman, L. J., Magnesio, B., & Wood, C. (2018). Peer Tutoring JOPERD: *The Journal of Physical Education, Recreation and Dance, 84*(3), 43-48.

Choudhury, I. (2006). Use of bidirectional and reciprocal peer tutoring techniques in an environmental control systems course at an undergraduate level. *Journal of Construction Education, 7*(3), 137-142.

Chukwu, A. (2012). Promoting student interest in mathematics using local games. *International Journal of Arts and Technology*, 2(1), 54-56

Cockeril, M., Craig N., & Thurston, A. (2018). Teacher Perceptions of the impact of Peer Learning in their Class-room: Using Social interdependence Theory as a model for Data Analysis and Presentation. *International Journal of Education and Practice, 6*(1), 14-27.

Costantini, S. T. (2015). The impact of peer tutoring strategies on Student learning in social studies. Curriculum and instruction: inclusive education department of curriculum institution, Masters Research thesis, The State University of New York at Fredonia, New York.

Crowder, C. L., & McCaskey, S. J. (2015). Reflection on one's own teaching style and learning strategy can affect the CTE classroom. *CTE Journal, 3*(1), 2-12.

Cullen, R., Harris, M., & Hill, R. R. (2012). *The learner-centered curriculum: Design and implementation*. San Francisco, CA: Jossey-Bass.

Dixon-Krauss, L. (2006). Vygotsky's socio-industrial perspectives on learning and its application to western literacy instruction. In L. Dixon-Krauss (Eds) *Vygotsky in the classroom: Mediated literacy instruction and assessment.* White Plains, NJ: Longman.

Ene, F. N. (2012). Effect of cloze instructional approach on senior secondary school students' achievement in English reading comprehension. *Unpublished PhD thesis,* University of Nigeria, Nsukka.

Esteve, B. M. (2015) Bidirectional peer tutoring and treatment integrity of elementary school students. *Master's Thesis,* Louisiana State University.

Evans, R. D. Y. (2010). Effects of bidirectional peer tutoring on academic achievement and social interaction of elementary students with emotional behavioural disorders. *A PhD Dissertation* submitted to the Graduate Faculty of North Carolina State University.

Eze, T. I., Ezenwafor, J. I., & Molokwu, L. I. (2019). Effects of meta-learning teaching method on the academic performances of building trade students in technical colleges in South-East Nigeria. *International Journal of Vocation and Technical Education, 7*(10), 101-108.

Eze, T. I., Obidile, J. I., & Akamobi, O. G. (2020). Relative effectiveness of constructivism and meta-learning teaching methods on students' academic achievement and retention in basic electricity in technical colleges. *European Journal of Training and Development Studies, 7*(1), 55-63.

Ezenwosu, S. U. (2013). Effect of peer tutoring and conventional lecture method on students' academic achievement and interest in Biology. *Unpublished Master's thesis,* University of Nigeria, Nsukka.

Ezugwu, A. (2016). Promoting students' in mathematics using local games. *International Journals of Arts and Technology Education, 2*(1), 54-66.

Fantuzzo, J. W., Polite, K. & Grayson, N. (2010). An evaluation of bidirectional peer tutoring across elementary school settings. *Journal of Social Psychology, 28*(1), 309-323.

Federal Republic of Nigeria (FRN, 2014). Federal ministry of education report of technical and vocational education. FME. Abuja.

Federal Republic of Nigeria (FRN, 2014). *National policy of education.* (6th Ed.) Nigerian Educational Research and Development Council (NERDC) press, Yaba- Lagos Nigeria.

Fung, F., Tan C., & Chen G. (2018). Student engagement and mathematics achievement: Unraveling main and interactive effects. *Psychology in the schools*, 55(7), 815-831. https://doi.org/10.1002/pits.22139

Galloway, C. A. (2017). Vygotsky's learning theory. In M. Orey (Eds) Emerging perspectives on learning, teaching and technology. Available Website: *http://projects.coe.uga.edu/epltt/index.php?title=Vygotsky%27,constructivism*

Gombe State Ministry of Land and Survey (2018). Gombe State Cordinate

Hashim, A., Ababkr, T. E. I. S., & Eljack, N. S. A. (2015). Effects of inquiry based science teaching on Junior Secondary School Students' academic achievements: A case study in Hadejia zonal Education Area of Jigawa State, Nigeria. *SUT Journal of Humanities, 16*(1), 156-169.

Haynie, W. J. (2013). Effects of pre-test and post-tests on delayed retention learning in Technology Education. *North Carolina Journal of Technology Teacher Education,* 6(2), 14-21.

Hidi, S. & Baired, W. (2006). Interestingness A neglected variable in discourse processing. *Cognitive science,* 1(10), 179-194.

Idris A. M. (2019). Effect of cognitive apprenticeship instructional method on auto-mechanics students. *AU journal of Technology, 16*(2), 89-98.

Igbo, J.N. (2018). Effect of peer tutoring on the mathematics achievement of learning disabled children. *Unpublished PhD thesis,* Faculty of Education, University of Nigeria, Nsukka.

Igbo, J. N., & Ihejiene, M. A. (2015). Gender differences, delinquent behaviours and academic achievement of secondary students in Nigeria. *International Journal of Latest Research in Science and Technology, 3*(4), 2278-2299.

Ige, J. O., Toyogo, E. A., & Oyegoke, D. A. (2017). An analysis of urban secondary school student's interest in teaching profession in South-Western Nigeria. *Global Journal of Human Social Science, 11*(9), 1-7.

Irfan, U. Rabia, T. & Muhammad, K. (2018). Effects of peer tutoring on the academic achievement of students in the subject of Biology at secondary level. *Education Sciences, 112*(8), 1-11.

John, T. M. (2016). Effects of bidirectional and reciprocal peer tutoring strategies on students' mathematical problem-solving achievement in electricity concepts in physics. *International Journal of Education, Learning and Development, 4*(3), 37-44.

Johnson, D.W., & Johnson, R.T. (1985). Cooperation and the use of technology. The *University of Minnesota Journal, 1*(1), 1-18.

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, 38(5), 356-379.

Kanuka, H. (2010). Characteristics of effective and sustainable teaching development programs for quality teaching in higher education. *Higher Education, Management and Policy, 22*(2), 1-14.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2016). Why minimal guidance during instruction does not work: an analysis of the failure of constructivism, discovery, problem-based experimental and inquiry-based teaching. *Education Psychologist, 41*(2), 86-95.

Krapp, A. (2010). An educational-psychological theory of interest and its relation to SDT. In E. L. Deci and R. M. Ryan (Eds.) *Handbook of self-determination research.* Rochester: University of Rochester Press.

Kurt, H., & Becker, S. M. (2014). A comparison of student's achievement and attitudes between constructivist and traditional classroom environment in Thailand vocational electronic programs. *Journal of Vocational Education and Research, 29*(2), 1-10.

Lin, H. (2015). Gender differences in science performance. *Journal of Studies in Education, 5*(4), 181-190.

McClnerney, D. M., Dowson, M., Young, A. S., & Nelson, G. F. (2015). *Self-esteem, academic interest and academic performance.* The influence of significant others. University of Western Sydney, Australia.

Miller, F. H., & Louw, J. (2014). Learning environment, motivation and interest Perspectives self-determination theory. *South African Journal of Psychology, 35* (1), 234-246.

Moore, J. (2010). *Reflective teaching: Becoming an inquiring education*. New York MacMillan Publishing Company.

Mostrom, A., & Blumberg, P. (2012). Does learning-centered teaching promote grade improvement? *Innovative Higher Education, 37*(5), 397-405.

National Board for Technical Education (NBTE, 2013). *National vocational certificate (NVC). Curriculum and module specification in basic electricity trades.* NBTE, Kaduna Government Press.

National Business and Technical Examinations Board (NABTEB) (2015). Chief examiner's report.

Nduji, C. C., & Madu, B. C. (2020). Influence of gender and location on students' conception of heat energy in senior secondary school Physics. *British Journal of Education, 8*(6), 1-17.

Nwaukwa, F. C., & Okolocha, C. C. (2020). Effects think-pair-share instructional strategy on students' academic achievement and self-efficacy in financial accounting in Abia State, *International Journal of Recent Innovations in Academic Research, 4*(1), 37-48.

Nweke, J. N. (2017). Material Resource Management for Effective Teaching of Electrical/Electronic Technology in Colleges of Education (Tech) (*Doctoral dissertation*). Department of Vocational Teacher Education, University of Nigeria, Nsukka

Obo, F. E. (2012). Some student personal variables as predictors of mathematics achievement in secondary school in central Cross-River State, Nigeria. Master's Thesis, University of Calabar, Calabar.

Oczkus, L. (2018). *Reciprocal teaching at work: Powerful strategies and lessons for improving reading comprehension*. Third edition. Newark, DE: International Reading Association.

Odeh, R. C., Oguche, O. A., & Ivagher, E. D. (2018). Influence of school environment on academic achievement of student in secondary schools in the zone a senatorial district of Benue State, Nigeria. *International Journal of Research Science Research, 6*(7), 4914-4922.

Ogbu, J. E. (2018). Influences of inadequate instructional materials and facilities in teaching and learning of electrical/electronic technology education courses. *International Journal of Vocational and Technical Education, 7*(3), 20-27.

Ogbuanya, T. C., & Owodunmi, A. S. (2016). Effects of reflective inquiry instructional techniques on students' achievement and interest in Radio-Television and Electronic Works in Technical Colleges. *IOSR Journal of Engineering (IOSRJEN), 3*(2), 1-11.

Ogide, C. J. (2017). Effect of computer simulation instruction on the academic achievement of students in basic technology class in Onelga Rivers State. *Unpublished Master's Thesis,* submitted to Rivers State University, Port Harcourt.

Ogundola, P. I. (2017). Effects of Peer Tutoring Strategy on Academic Achievement of Senior Secondary School Students in Technical Drawing in Nigeria, *British Journal of Education, Society & Behavioural Science, 19*(1), 1-10

Ogwa C. E. (2002). Strategies for improving electronic instruction. *Ebonyi State University Journal of Education.* 3(1), 43-48.

Okilwa, N. S., & Shelby, L. (2010). The effects of peer tutoring on academic performance of students with disabilities in grades 6 through 12: A synthesis of the literature. *Remedial and Special Education, 31*(6), 450-463.

Okoro, O. M. (20I6). *Measurement and evaluation in education,* 2nd Edition. Uruomulu Obosi: Pacific Publishers.

Olasehinde, K. J., & Olatoye, R. A. (2018). Comparison of male and female Senior Secondary School students' learning outcomes in science in Katsina State, Nigeria. *Mediterranean Journal of Social Sciences,* 5(2), 517-523.

Owodunni, A. S., & Ogundola, I. P., (2018). Gender differences in the achievement and retention of Nigerian students exposed to concepts in electronics work trade through reflective inquiry instructional techniques. *British Journal of Education, Society and Behavioral Science, 3*(4), 589-599.

Perkins, D. N. (2000). Person-plus: A distributed view of thinking and learning. *Distributed Cognition.* New York: Cambridge University Press.

Piaget, J. (1937). *The construction of reality in children.* Delachauxet Niestle, Neuchatel.

Pigott, R., Fantuzzo, J. W., Heggie, N. H., & Clement, K. (2004). Effects of bidirectional peer tutoring on children with academic needs. *Journal of Social Psychology, 1*(18), 203-223.

Radu, L. (2016). Centeredness of education in The United States. *Bulletin of the Transylvanian University of Brasov*: Series VII: Social Sciences, 9(2), 43-50.

Robinson, N. R. (2018). Effectiveness of computer aided instructions (CAI) on student performance in basic electricity in technical colleges in Rivers State of Nigeria, *International Journal of Research-Granthaalayah, 5*(11), 14-21.

Saka-Alikinla, I. Owodunni A. S., & Babatunde H. W. (2019). Comparative effects of structured and guided inquiry instructional techniques on student's academic achievement in basic electricity in Kwara State technical colleges. *British Journal of Applied Science & Technology, 14*(6), 1-10.

Schreurs, J. & Roza, D. (2014). A shift from teacher-centered to learner-centered approach. *International Journal of Engineering Pedagogy*, *4*(3), 36-39.

Schun, O. (2018). *Learning theories*: An educational perspective (5th ed). Upper – Saddle River, NJ. Prentice-Hall.

Shehu, I. Y. (2015). Effect of multimedia instruction on student's academic achievement and retention in auto mechanics at technical colleges. *ATBU Journal of Science, Technology, and Education (JSTE), 5*(2), 91-100.

Shodeinde, A. O. (2013). Effect of Cognitive Mind Mapping on the Achievement of Electrical and Electronic Trades Students. *Unpublished Master's thesis,* Department of Vocational Teacher Education, University of Nigeria, Nsukka.

Silvia, P. J. (2018). *Exploring the psychology of interest*. New York: Oxford University Press.

Smith, D. J., & Valentine, T. (2012). The use and perceived effectiveness of instructional practices in two-year technical colleges. *Journal on Excellence in College Teaching, 23*(1), 133-161.

Stefaniak, J. E., & Tracey, M. W. (2015). An exploration of student experiences with learner-centered instructional strategies. *Contemporary Educational Technology*, 6(2), 95-112.

Taale, K. D., & Mustapha B. A. (2014). Effects of teacher-constructed electrical models on students' academic achievement in basic electricity in technical colleges of

Borno state, Nigeria. *International Journal of Innovative Social & Science Education Research, 2*(1), 16-25.

Tawalbeh, T. I., & Al-asmari, A. A. (2015). Instructors' perceptions and barriers of learner-centered instruction in English at the university level. *Higher Education Studies, 5*(2), 38-51.

Tella, A. (2013). The effect of peer tutoring and explicit instructional strategies on primary school pupils learning outcomes in mathematics. *Bulgarian Journal of Science and Education Policy* 7(1), 1-25.

Topping, K., Buchs, C., Duran D., & Van Keer, H. (2017). Effective peer learning: From principles to practical implementation. Routledge.

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

Udogwu, M. E., & Njeleta, C. B. (2010). Effects of constructivist based instructional models on student's conceptual change and retention in chemistry. *African Research Review. International Multi-Disciplinary Journal. Ethiopia, 4*(2), 219-229.

Ugwanyi, E. C. (2018). Effects of an ethno science based instructional model on students' academic achievement and interest in senior secondary school biology. *Unpublished master thesis*: University of Nigeria, Nsukka.

Umoru, E. S., & Onoja, A. I. (2017). Comparative effects of two instructional approaches on Biology students' academic achievement in evolution: Implication for curriculum review. *Journal of curriculum organization of Nigeria, (CON), 1*(12), 85-97.

United Nation Educational, Scientific and Cultural Organization (2015). Recommendation concerning technical and vocational education and training. Paris, UNESCO.

Uroko, J. E. (2010). Effects of bidirectional peer tutoring on achievement, interest and perceived self-efficacy in reading comprehension of some secondary school students in Enugu State, Nigeria. *Unpublished PhD thesis*. The University of Nigeria, Nsukka.

Uwameiye, R., & Aduwa-Ogiegbean, S. E. O. (2016). Effect of reciprocal peer tutoring on the academic achievement of students in introductory technology. *Journal of Instructional Technology and Distance Learning, 3*(6), 1-7.

Vanessa, C. (2017). Student achievement: Definition, factors and research. Retrieved August 14 2017 from http://study.com/academy/lesson/student-achievement-definition-factors-research.html.

Voyer, D., &Voyer, S. D. (2014). Gender differences in scholastic achievement: A meta-analysis. *Psychological Bulletin, 140*(4), 1174-1204.

Vygotsky, L. S. (1978). *Tool and symbol in child development*. Cambridge: Mass Harvard University Press.

Wei, X. (2017). Using student voice in learner-centered course design. *Educational Research and Reviews, 12*(7), 403-414.

Weimer, M. (2013). *Learner-centered teaching: Five key changes to Practice* (2nd Ed.).

Wertsch, J. V. (2001). *Vygotsky and the social formation of mind.* Cambridge, Mass: Harvard University Press.

Wright, G. B. (2011). Student-centered learning in higher education. *International Journal of Teaching and Learning in Postsecondary Education, 23*(1), 92-97.

Yeung, R. (2015). Athletics, athletic leadership and academic achievement. *Journal of education and urban society, 47*(3), 361-387.

Yusuf, M. O., Gambari, A. I., & Olumorin, C. O. (2012). Effectiveness of computer-supported cooperative learning strategies in learning physics. *International Journal of Social Studies and Education, 2*(2), 94-109.

Zakaria, A. B., Chine, S. K., & David T. O. (2015). *The Implication of Computer on the Performance of Students of Electricity in Colleges.* California: Sparrow Publishers.

Zechariah, C. P. (2016). Comparative effects of jigsaw strategies and peer tutoring strategies on students' achievement and interest in algebra. *Unpublished master's Thesis,* University of Nigeria, Nsukka.

APPENDIX A

LETTER OF REQUEST FOR NTC I BASIC ELECTRICITY STUDENTS STATISTICS FOR 2020/2021 ACADEMIC SESSION IN GOMBE STATE

Department of Industrial and Technology Education,
Federal University of Technology
Minna, Niger State.
22nd February. 2020.

Sir,

I am a postgraduate student of the above-mentioned department and institution currently researching the "**EFFECTS OF PEER TUTORING INSTRUCTIONAL APPROACHES ON TECHNICAL COLLEGE STUDENTS' ACHIEVEMENT, INTEREST AND RETENTION IN BASIC ELECTRICITY IN GOMBE STATE, NIGERIA".** You are kindly requested to provide in the table below the statistics of students offering basic electricity in Gombe State technical colleges to serve as a basis for carrying out this research.

You are also expected to authenticate the information given by signing and stamping on the filled table. The information provided will only be used for this research purpose.

Thank you.

Yours faithfully

Muhammad Samaila
M.TECH/SSTE/2018/8827

APPENDIX B

DISTRIBUTION OF STUDENTS' POPULATION

S/N	NAME OF INSTITUTIONS	BOYS	GIRLS	TOTAL
1.	Government Science Technical College Burendi	31	12	43
2.	Government Science Technical College Gombe	40	11	51
3.	Government Science Technical College Kumo	39	07	46
4.	Government Science Technical College Amada	36	18	54
5.	Government Science Technical College Tula	26	13	39
6.	Government Science Technical College Kwami	35	05	40
	TOTAL			273

SCIENCE AND TECHNICAL SCHOOLS BOARD
Sign
17/3/2020
Date
GOMBE STATE

APPENDIX C

LETTER OF REQUEST FOR BASIC ELECTRICITY NABTEB RESULTS IN GOMBE STATE TECHNICAL COLLEGES FROM 2015-2019

Department of Industrial and Technology Education,
Federal University of Technology
Minna, Niger State.
22nd February. 2020.

Sir,

I am a postgraduate student of the above mentioned department and institution currently conducting research on the **"EFFECTS OF PEER TUTORING INSTRUCTIONAL APPROACHES ON TECHNICAL COLLEGE STUDENTS' ACHIEVEMENT, INTEREST AND RETENTION IN BASIC ELECTRICITY IN GOMBE STATE, NIGERIA".** You are kindly requested to provide in the table below the statistics of students offering basic electricity in Gombe State technical colleges to serve as a basis for carrying out this research.

You are also expected to authenticate the information given by signing and stamping on the filled table. The information provided will only be used for this research purpose.

Thank you.

Yours faithfully

Muhammad Samaila
M.TECH/SSTE/2018/8827

S/N	ACADEMIC SESSION	No of student with Credit pass and above	No of student with Fail	Total
1	2014/2015	86	87	173
2	2015/2016	102	103	205
3	2016/2017	96	98	194
4	2017/2018	93		
5	2018/2019	105		

SCIENCE AND TECHNICAL SCHOOLS BOARD
GOMBE STATE
Sign
17/3/2020
Date

APPENDIX D

LETTER OF REQUEST FOR EXPERT VALIDATION OF RESEARCH INSTRUMENT

Department of Industrial and Technology Education,
Federal University of Technology
Minna, Niger State.
22nd February. 2020.

Sir,

REQUEST FOR VALIDATION OF RESEARCH INSTRUMENT

Your kind gesture is needed to ascertain the credibility and suitability of this instrument on the **EFFECTS OF PEER TUTORING INSTRUCTIONAL APPROACHES ON TECHNICAL COLLEGE STUDENTS' ACHIEVEMENT, INTEREST AND RETENTION IN BASIC ELECTRICITY IN GOMBE STATE, NIGERIA**

I, therefore, request that you validate the attached instruments: Lesson plans, Achievement test, and Interest inventory.

You are obliged to remove or add items(s) necessary for the actualization of the set goal. The proficiency of the project is based on the accuracy of this instrument, and as such, your kind opinions on the above subject matter are highly valuable.

Thanks you.

Yours faithfully,

Muhammad Samaila.
MTech/SSTE/2018/8467

APPENDIX E

VALIDATION CERTIFICATE

This is to certify that the instrument on the research work titled: **EFFECTS OF PEER TUTORING INSTRUCTIONAL APPROACHES ON TECHNICAL COLLEGE STUDENTS' ACHIEVEMENT, INTEREST AND RETENTION IN BASIC ELECTRICITY IN GOMBE STATE, NIGERIA**

Was validated by:

Name: Dr. E. Raymond

Institution: FUT Minna

Department: I.T.E

Signature and Date: 28/5/2021

Name: Usman, G. A. (PhD)

Institution: FUT Minna

Department: ITE Department

Signature and Date: 17/05/2021

Name: Maxwell E. Udhafemhe, PhD.

Institution: National Examinations Council

Department: Psychometrics Department

Signature and Date: 10/04/2021

APPENDIX F

BIDIRECTIONAL PEER TUTORING INSTRUCTIONAL APPROACH

LESSON PLANS

LESSON 1

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Structure of Matters
Week	One
Time	
Duration	90 Minutes
Method	**Bidirectional Peer Tutoring Instructional Approach**
Instructional Materials	A pen, sheet of paper to jot down notes and cardboard paper showing diagrams of the states of matter.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. Define Molecule, Electron and Atom. 2. Explain the difference between positive and negative charges. 3. Explain the flow of electricity. 4. Distinguish between insulators and conductors.
Entry Behaviour	The students are familiar with the state of matter.

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGY
Structure of Matter	**STEP I** **Set Induction**	The teacher introduces the lesson by asking the students some questions based on their previous lesson on states of matter. He then introduces the topic for the day which is Structure of Matters.	The students listen to the teacher and respond to the teacher's questions and write down the topic of the day.	Questioning,
	STEP II **Grouping the Students**	The teacher divides the students into groups of four using a simple random sampling technique. (a) Predictor/tutor (b) Clarifier (tutee) (c) Questioner (tutee) (d) Summarizer (tutee) (e) Monitor (tutee)	The students pick their roles as: a) Predictor (tutor) b) Clarifier (tutee) c) Questioner (tutee) d) Summarizer (tutee) **e)** Monitor (tutee and group monitor)	Organization of peer collaboration
Presentation **Definition of matter**	**STEP III** **Practicing Bidirectional Peer Tutoring Process**	The teacher presents the cardboard paper showing diagrams of the states of matter, he then distributes one note card to each member of the group identifying each person's role in the group. He also presents the photocopies of note on Structure of Matters to the students as: a) Definition of molecule, electron and atom. b) Different between positive and negative charges. c) The flow of electricity.	**Predicting:** The predictor/tutor distributes photocopies of notes of Structure of Matters and asks the students in his group to read the note. The tutor allows the students to read up to a certain point. **Clarification:** The clarifier allows the readers to have any unfamiliar words cleared. **Questioning:** The questioner gets the students to generate the questions at this Point. The questions can be answered orally or depending .on the teacher's purpose, he might like the group to	Collaboration, prediction, clarifying, questioning, summarizing, explanation and discussion.

		d) Different between insulators and conductors.	record their questions and answers. **Summarizing:** The summarizer highlights the key ideas at this point of the topic. The students try to note the main points in the topic. For instance, (a) What is molecule, electron and Atom? (b) What is the difference between positive and negative charges? (c) What is the difference between insulators and conductors? **Monitoring:** The group monitor evaluates to determine where scaffolding is needed to help students to be successful in the peer strategy.	
	STEP IV **Switching of Roles**	The teacher supervises and guides if need be	The roles in the group then switch one person to the right for the next selection in the next lesson.	
Evaluation		The teacher asks students questions based on the objectives of the lesson as follows: (a) What is a molecule, electron, and Atom? (b) What is the difference between positive and negative charges? (c) What is the difference between	The students' attempt the teacher's Questions.	Questioning discussion and exercise.

		insulators and conductors?		
Conclusion		The teacher monitors the groups, and evaluate the extent at which the objectives have been achieved.		

LESSON 2

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Chemical sources of electromotive force
Week	Two
Time	
Duration	90 Minutes
Method	**Bidirectional Peer Tutoring**
Instructional Materials	cardboard paper showing the diagrams of series and parallel connection of the circuit
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. Define work, power and energy. 2. Differentiate between e.m.f and potential difference (p.d). 3. Identify the application of primary and secondary cells. 4. Draw cells in series, parallel and series-parallel. 5. Test for the condition of a cell or battery.
Entry Behaviors	The students have learned about the Structure of matter.

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGY
Electromotive force (E.M.F)	**STEP I** **Set Induction**	The teacher Asks the students base on their previous knowledge to explain work, power and energy and their units of measurement. He then presents the new topic to them.	The students carefully respond to the teacher's questions.	Questioning
	STEP II **Initial Teaching**	The teacher guide the students in the skills of the bidirectional peer tutoring process. These skills include: - predicting, clarifying, questioning, Summarizing and monitoring. The teacher supervises rather than participate in the intervention.	The students follow the teacher's explanation, notes, and important points and ask questions.	Illustration, example explanation and questioning
	STEP III **Grouping the Students**	The teacher puts the students in groups of four. The teacher distributes a notecard to each member of the group identifying each person's unique role.	The students respond to the grouping arrangement and pick their unique roles as: (a) Predictor / tutor (b) Clarifier (tutee) (c) Questioner (tutee) (d) Summarizer (tutee) (e) Monitor (tutee/group monitor)	Organization of peer Collaboration.
Presentation	**STEP IV** **Practicing the Bidirectional Peer Tutoring**	The teacher hands over the photocopies of notes on Electromotive force (E.M.F) to the predictor. The teacher guides them during clarification and	Predicting**:** The tutor distributes copies of notes on Electromotive force (E.M.F) to the group members to read	Collaboration, predicting, clarifying, questioning, summarizing, monitoring,

		discussion. The contents are: a) Work, power and energy b) The difference between e.m.f and p.d c) Types of batteries d) Drawing of cells in series, parallel, series-parallel connection	and deliberate on it and then predict what the rest of the note will be about. **Clarification:** The clarifier allows the readers to read again so that to identify any unfamiliar term. **Questioning:** The questioner gets the students to generate the questions at this point. The questions could be: a) Define work, power and energy? b) Mention the difference between emf and p.d? c) What is the difference between primary and secondary cells? **Summarizing:** The summarizer highlights the key ideas of the lesson. **Monitoring:** The group monitor evaluates the lesson to determine whether Students comprehend the topic successfully.	Explanation and Discussion.
	STEP V **Switching of Roles**	The teacher supervises and guides if need be.	The students repeat the process in the next lesson	

			using their new roles.	
Evaluation		The teacher asks students' the following questions: a) Define work, power and energy? b) Mention the difference between emf and p.d? c) What is the difference between primary and secondary cells?	The students attempt to answer the teacher's questions.	Questioning discussion and exercise.
Conclusion		The teacher monitors the groups, to evaluate the extent to the objectives have been attained.		

LESSON 3

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Construction of resistors, inductors and capacitors
Week	Three
Time	
Duration	90 Minutes
Method	**Bidirectional Peer Tutoring**
Instructional Materials	A cardboard paper showing the diagrams and symbols of resistor, capacitor and inductor.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. States the types of resistors, capacitors and inductors 2. State the functions of resistors and capacitors and inductors. 3. Explain the resistors' power rating. 4. State the application of various types of resistor. 5. Identify the working voltage of a capacitor.
Entry Behaviour	The students have learnt about chemical sources of electromotive force.

INSTRUCTIONAL PROCEDURE

CONTENT	**CONTENT DEVELOPMENT**	**TEACHER'S ACTIVITIES**	STUDENTS' ACTIVITIES	STRATEGY
Resistors and capacitors in series and parallel.	**STEP I Set Induction**	The teacher introduces the lesson by asking the students some questions based on the previous lesson treated. He then introduces the topic for the day which is Resistors, Capacitors and Inductors.	The students respond to the teacher's questions and write down the topic of the day.	Questioning, illustration, examples.
	STEP II Grouping the Students	The teacher supervises the students as they pick the note cards identifying each person's new role after the second selection.	The students pick their roles as: a) Predictor (tutor) b) Clarifier (tutee) c) Questioner (tutee) d) Summarizer (tutee) **e)** Monitor (tutee and group monitor)	Organization of peer Collaboration
Presentation	**STEP III Practicing the Bidirectional Peer Tutoring Process**	The teacher present the photocopies of note on Resistors, capacitors and inductors to the tutor. He then supervises the predictor and the tutees as they collect notes on the Resistors, capacitors and inductors. He also supervises how they organize the clarification exercise and guide them if the need arises. The contents are: a) Types of resistors, capacitors and inductors. b) Functions of resistors,	**Predicting:** The predictor/tutor distributes the note on Resistors, capacitors and inductors and asks the students in his group members to read the note. **Clarification:** The clarifier gives an explanation of Resistors, capacitors	Collaboration, prediction, clarifying, questioning, summarizing, explanation and discussion

		capacitors and inductors. c) Resistors' power rating. d) Application of various types of resistors.	and inductors. **Questioning:** The questioner gets the students to generate the questions at this point, which may be answered orally or the group might record their questions and answers. The questions are (a) List types of resistors, capacitors and inductors and their units? (b) States the function of resistor, capacitor and inductor? (c) Explain resistors' power rating? **Summarizing:** The summarizer highlights the key points in the lesson. The students note the key points in the topic discussed. **Monitoring:** The group monitor evaluates to determine where scaffolding is	

			needed to help students to be successful in using the bidirectional peer tutoring strategy.	
	STEP IV Switching of Roles	The teacher help faded out from the intervention allowing the students to collaborate between themselves.	After the above step, it would be noted that every member of the group of five students has participated as a tutor and a tutee the lesson as well as serving as a group monitor.	
Evaluation		The teacher ask students as follows: (a) List types of resistors, capacitors and inductors and their units? (b) States the function of resistor, capacitor and inductor? (c) Explain the resistors' power rating?	The students respond to the teacher's questions.	Questioning and Discussion.
Conclusion		The teacher concludes the lesson by giving the student an assignment to do.		

LESSON 4

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Resistor Colour Coding
Week	Four
Time	
Duration	90 Minutes
Method	**Bidirectional Peer Tutoring**
Instructional Materials	A cardboard paper showing the diagrams and symbols of the resistor, showing their colour codes and values.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. Explain the colourcoding system of resistors and capacitors. 2. Identify the tolerance of resistors and capacitors. 3. State the value of tolerance of any resistor. 4. Calculate the resistance of a resistor using colour codes. 5. Calculate the capacitance of a capacitor using colour codes.
Entry Behaviour	The students have learned about the construction of resistors and capacitors.

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Resistor Colour Coding	**STEP I Set Induction**	The teacher introduces the lesson by asking the students some questions based on the previous lesson treated. He then introduces the topic for the day which is the values and functions of a resistor.	The students respond to the teacher's questions and write down the topic of the day.	Questioning
	STEP II Initial Teaching	The teacher guide the students in the skills of the bidirectional peer tutoring process. These skills include: - predicting, clarifying, questioning, Summarizing and monitoring. The teacher supervises rather than participate in the intervention.	The students follow the teacher's explanation, note important points and ask questions.	Illustration, example explanation and questioning
	STEP III Grouping the Students	The teacher puts the students in groups of four. The teacher distributes a notecard to each member of the group identifying each person's unique role.	The students respond to the grouping arrangement and pick their unique roles as: (a) Predictor / tutor (b) Clarifier (tutee) (c) Questioner (tutee) (d) Summarizer (tutee) (e) Monitor (tutee/group monitor)	Organization of peer collaboration.

Presentation	**STEP IV Practicing the Bidirectional Peer Tutoring Process**	The teacher hands over the model of resistor, colour codes of resistors on the cardboard paper and photocopies of notes on values and functions of resistor to the predictor. The teacher guides them during clarification and discussion. The contents are: a) Colour coding system of resistors b) Tolerance of resistors c) Value of tolerance of resistor d) Calculation of tolerance of resistors through colour codes.	Predicting**:** The tutor distributes copies of notes on values and functions of resistors to the group members to read and deliberate on it and then predict what the rest of the note will be about. **Clarification :** The clarifier gives the readers the opportunity to read again so that to identify any unfamiliar term. **Questioning:** The questioner gets the students to generate the questions at this point. The questions could be: (a) What is a colour code of a resistor? (b) What is the function of a resistor? (c) State the value of tolerance	Collaboration, predicting, clarifying, questioning, summarizing, monitoring, Explanation and discussion.

			of any resistor. **Summarizing:** The summarizer highlights the key ideas of the lesson. **Monitoring:** The group monitor evaluates the lesson to determine whether Students comprehend the topic successfully.	
	STEP V Switching of Roles	The teacher supervises and guides if need be.	The students repeat the process in the next lesson using their new roles.	
Evaluation		The teacher asks students' the following questions: (a) What is a colour code of a resistor? (b) What is the function of a resistor? (c) State the value of tolerance of any resistor.	The students attempt to answer the teacher's questions.	Questioning discussion and exercise.
Conclusion		The teacher monitors the groups to evaluate the extent to the objectives have been attained.		

LESSON 5

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Ohm's law and its application
Week	Five
Time	
Duration	90 Minutes
Method	**Bidirectional Peer Tutoring**
Instructional Materials	A cardboard paper showing diagrams of series and parallel connection of resistor, capacitors and batteries.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. Define ohm's law 2. Calculate resistance, voltage and current using Ohm's law. 3. Draw resistors in series, and parallel connection. 4. Draw Batteries in series and parallel connection. 5. Draw capacitors in series, and parallel connection.
Entry Behaviour	The students have learned about Resistor Colour Coding.

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Ohm's law and its application	**STEP I** **Set Induction**	The teacher requires the students to mention the processes involved in bidirectional peer tutoring as a peer collaboration strategy.	The students respond to the teacher's questions and write down the topic of the day.	Questioning, Examples
	STEP II **Grouping the Students**	The teacher supervises the students as they pick note cards identifying each person's new role after the second selection.	The students pick their roles as: a) Predictor (tutor) b) Clarifier (tutee) c) Questioner (tutee) d) Summarizer (tutee) **e)** Monitor (tutee and group monitor)	Organization of peer collaboration
Presentation **Definition of ohm's law**	**STEP III** **Practicing the Bidirectional Peer Tutoring Process**	The teacher present cardboard papers showing diagrams of series and parallel connection of resistor, inductor, batteries and capacitor to the students. He supervises the predictors/tutors as they collect photocopies of the note on Ohm's law and its application. He also supervises how they organize the clarification exercise since his intention is to leave the students to collaborate between themselves as each learner acts in response to another. The contents are: a) Definition of Ohms' law	**Predicting:** The predictor/tutor distributes note on Ohm's law and its application to the students in his group to read. Then predict what the rest of the note will be about. The tutor raises his hand which invites the group members to read too. He read the note given by the teacher and explain the function of each part to the group. **Clarification:** The clarifier gives the readers the opportunity	Collaboration, prediction, clarifying, questioning, summarizing, explanation and discussion.

		b) Calculation of resistance, voltage and current using Ohms' law. c) Resistors in series and parallel. d) Batteries in series and parallel. e) Capacitors in series and parallel.	to have any new term or words understand it meaning. **Questioning:** The questioner gets the students to generate the questions at this point, which may be answered orally or the group might record their questions and answers. For instance, the questions could be (a) Define ohm's law? (b) Calculate resistances, current and voltage using Ohm's law? (c) Draw battery in a series-parallel connection? **Summarizing:** The summarizer highlights the main points of the lesson. The students note the key points in the lesson and try to paraphrase some sentences. The summarizer names individual students in his group after raising each question for the student to answer. **Monitoring:** The group	

			monitor, evaluates to determine where scaffolding is needed to help students to be successful in using the bidirectional peer tutoring strategy.	
	STEP IV Switching of Roles	The teacher asks the students to collaborate between themselves as each learner acts in response to another.	The roles in the group then switch one person to the right for the next selection in the next lesson.	
Evaluation		The teacher asks the following questions: (a) Define ohm's law? (b) Calculate resistances, current and voltage using Ohm's law? (c) Draw battery in a series-parallel connection?	The students respond to the teacher's questions.	Questioning discussion and exercise.
Conclusion		At the end of the entire exercise the teacher encourages the students to continue to pursue learning on their own after the classes using bidirectional peer tutoring skills in their independent learning process.		

Date	**LESSON 6**
Schools	
Class	NTC I
Subject	Basic electricity
Topic	AC and DC quantities
Week	Six
Time	
Duration	90 Minutes
Method	**Bidirectional Peer Tutoring**
Instructional Materials	A cardboard paper showing the difference between AC and DC current and voltage.
Behavioural Objectives	By the end of the lesson, the students should be able to: (i) Explain the difference between AC and DC. (ii) Explain the characteristic of alternating current. (iii) Define peak value, mean value, and RMS value. (iv) Describe the simple treatment of R,L,C in AC circuit. (v) Calculate inductive and capacitive reactance.
Entry Behaviour	The students have learned about Ohm's law and its application.

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Magnetism	**STEP I** **Set Induction**	The teacher explain each of the skills in bidirectional peer tutoring process to the students' which are: predicting, clarifying questioning, summarizing and monitoring. He then introduces the topic for the day, which is Magnetism.	The students rehearse the skills used in bidirectional peer tutoring, discussing with the teacher and dialogue between themselves as each student acts in response to another	Questioning, illustration, examples.
	STEP II **Grouping the Students**	The teacher group the students' in four groups and then distributes a note card to each member of the groups, identifying each person's role in the group.	The students pick their roles as: a) Predictor (tutor) b) Clarifier (tutee) c) Questioner (tutee) d) Summarizer (tutee) **e)** Monitor (tutee and group monitor)	Organization of peer collaboration
Presentation	**STEP III** **Practicing the Bidirectional Peer Tutoring Process**	The teacher guide and hands over the note on Magnetism to the predictor. The contents are: a)Explanation of the difference between AC and DC. b) The characteristics of alternating current. c) Definition of peak value, mean value and RMS value. Calculation of inductive and capacitive reactance.	**Predicting:** The predictor/tutor distributes the notes to the students' asks them to read the note. The tutor raises the prompt card, which invites the students to read up to a certain point in the note. **Clarification:** The clarifier gives the students' the opportunity to identify any unfamiliar word or term. **Questioning:** The questioner made students to generate the questions at this point. The questions can be answered orally, or record it down depending on the teacher's	Collaboration, predicting, clarifying, questioning, summarizing, monitoring, Explanation and discussion.

			demand. For instance, the questions could be: (a) What is the difference between AC and DC? (b) Explain the characteristics of AC? (c) Define the following: i. Peak value, ii. Mean value iii. RMS value? (d) Calculate inductive and capacitive reactance? **Summarizing:** The summarizer highlights the points of the lesson. The Students' try to take note on the key points highlighted by the summarizer. The summarizer then called upon the name of an individual students in the group as he posed a questions and asked them to answer such questions raises. **Monitoring:** The group monitor evaluates the students' participation to determine whether they needs helps to be successful in using peer collaboration strategy.	
	STEP IV **Switching of Roles**	The teacher supervises and guides students.	The roles in the group then switch between the group member	

Evaluation		The teacher posed the following questions to the students: (a) What is the difference between AC and DC? (b) Explain the characteristics of AC? (c) Define the following: i. Peak value, ii. Mean value iii. RMS value? (d) Calculate inductive and capacitive reactance?	The students attempt the teacher's questions.	Questioning discussion and exercise.
Conclusion		The teacher monitors the groups evaluate the extent the objectives have been achieved and give students some assignment to do.		

LESSON 7

Date

Schools	
Class	NTC I
Subject	Basic electricity
Topic	Principles of transformers
Week	Seven
Time	
Duration	90 Minutes
Method	**Bidirectional Peer Tutoring**
Instructional Materials	A cardboard paper showing diagrams of transformers and the working principles of a transformer.
Behavioural Objectives	By the end of the lesson, the students should be able to: (i) Explain the concept of magnetism (ii) Explain temporary and permanent magnets (iii) Explain the concept of law of attraction and repulsion. (iv) Explain the types of losses in transformers (v) Mention types of transformer (vi) State the uses of each type of transformer.
Entry Behaviour	The students have learned about AC and DC quantities.

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGY
Transformer	**STEP I** **Set Induction**	The teacher rehearses each of the skills in bidirectional peer tutoring which include: predicting, clarifying questioning, summarizing and monitoring. He then introduces the topic for the day, which braking system.	The students rehearse the skills used in bidirectional peer tutoring, discussing with the teacher and dialogue between themselves as each student acts in response to another.	Questioning, illustration, examples
	STEP II **Grouping the Students**	The teacher distributes one note card to each member of the groups identifying each person's new role .	The students pick their roles as: a) Predictor (tutor) b) Clarifier (tutee) c) Questioner (tutee) d) Summarizer (tutee) **e)** Monitor (tutee and group monitor)	Organization of peer collaboration
Presentation	**STEP III** **Practicing Bidirectional Peer Tutoring Process**	The teacher guide and hands over the note on transformer to the predictor after explaining the objectives of lesson to the students. The contents are: a) Concept of magnetism. b) Temporary and permanent magnets. c) Law of attraction and repulsion. d) Types of losses in transformer.	**Predicting:** The predictor/tutor distributes Photocopies of note on transformer and asks the students in his group to read the note. The tutor allow the students to read up to a certain point. **Clarification:** The clarifier gives the readers the opportunity to have any unfamiliar words comprehend.	Collaboration, predicting, clarifying, questioning, summarizing, monitoring, Explanation and discussion.

		e) Types of transformer.	**Questioning:** The questioner gets the students to generate the questions at this point. The questions can be answered orally, or depending .on the teacher's purpose, he might like the group to record their questions and answers. The question are aimed at: Clarifying and Connecting to other concepts already Learnt. **Summarizing:** The summarizer highlights the key ideas at this point of the topic. The students try to note the main points in the topic. For instance, a). Explain the concept of magnetism? b). Explain temporary and permanent magnets? c) Mention law of attraction and repulsion? d) Explain the type of losses in transformer? The summarizer names individual students in the	

			group as he raises each question to answer such questions. **Monitoring:** The group monitor evaluates to determine whether the objectives of the lesson have been achieved.	
	STEP IV **Switching of Roles**	The teacher supervises and guides, if need be	The roles in the group then switch one person to the right for the next selection to in the next lesson.	
Evaluation		The teacher ask the students question as follows: a).Explain the concept of magnetism? b).Explain temporary and permanent magnets? c) Mention law of attraction and repulsion? d) Explain the type of losses in transformer?	The students attempt the teacher's questions.	Questioning discussion and exercise.
Conclusion		The teacher monitors the groups evaluate the extent the objectives have been achieved.		

LESSON PLAN 8

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Electronic signs and symbols
Week	Eight
Time	
Duration	90 Minutes
Method	**Bidirectional Peer Tutoring**
Instructional Materials	A chart showing Electronic signs and symbols.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1 Draw the symbols of transistor, amplifiers, switch and socket outlet. 2 Describe the function of Ammeter voltmeter 3 Describe the function of multi-meter 4 State how to identify fault using Ohm-meter.
Entry Behaviour	The students were taught about principles transformer

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Fluxes, Solder and Soldering	**STEP I** **Set Induction**	The teacher requires the students to mention the processes involved in bidirectional peer tutoring as a peer collaboration strategy.	The students respond to the teacher's questions and write down the topic lesson.	Questioning, Examples
	STEP II **Grouping the Students**	The teacher supervises the students as they pick note cards identifying each person's new role after the second selection.	The students pick their roles as: a) Predictor (tutor) b) Clarifier (tutee) c) Questioner (tutee) d) Summarizer (tutee) **e)** Monitor (tutee and group monitor)	Organization of peer collaboration
Presentation	**STEP III** **Practicing the Bidirectional Peer Tutoring Process**	The teacher supervises the predictors/tutors as they collect model and photocopies of the note on suspension system. He also supervises how they organize the clarification exercise since his intention is leaving the students to collaborate between themselves as each learner acts in response to another. The contents are: a) Symbols of transistors, amplifiers, switch and socket outlet. b) Functions of Ammeter and Volt-meter.	**Predicting:** The predictor/tutor distributes note on suspension system and to the students in his group to read. He then dismantles the model to identify each component parts of the system and present it to his group members see. Then predict what the rest of the note will be about. The tutor raises his hand which invites the group members to read too. **Clarification:** The clarifier gives the readers the opportunity to have any new term or words understand it meaning.	Collaboration, Predicting, Clarifying, Questioning, Summarizing, Monitoring, Explanation and Discussion.

		c) Function of multi-meter. d) How to identify fault using Multi-meter.	**Questioning:** The questioner gets the students to generate the questions at this point, which may be answered orally or the group might record their questions and answers. For instance, the questions could be a) Draw the symbols of the following: Transistor Amplifier Switch Socket outlet. b) Mention the functions of Ammeter and Volt-meter? c) Mention the functions of Multi-meter? **Summarizing:** The summarizer highlights the main points of lesson. The students note the key points in the lesson and try to paraphrase some sentences. The summarizer then names individual students in his group after raising each question for the student to answer such a question. **Monitoring:** The group monitor evaluates to	

			determine the lesson objectives have been achieved.	
	STEP IV Switching of Roles	The teacher allow the students to collaborate between themselves as each learner acts in response to another.	After the above step, it would be noted that every member of the group of four students has participated as a tutor and a tutee as well as serving as a group monitor.	
Evaluation		The teacher ask the following questions: a) Draw the symbols of the following: Transistor Amplifier Switch Socket outlet. b) Mention the functions of Ammeter and Volt-meter? c) Mention the functions of Multi-meter?	The students respond to the teacher's questions.	Questioning discussion and exercise.
Conclusion		The teacher monitors the groups, evaluate the extent the objectives of the lesson have been achieved.		

APPENDIX G

UNIDIRECTIONAL PEER TUTORING INSTRUCTIONAL APPROACH LESSON PLANS

LESSON 1

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Structure of Matters
Week	One
Time	
Duration	90 Minutes
Method	**Unidirectional Peer Tutoring Instructional Approach**
Instructional Materials	A pen, sheet of paper to jot down note and cardboard paper showing diagrams of the states of matter.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. Define Molecule, Electron and Atom. 2. Explain the difference between positive and negative charges. 3. Explain the flow of electricity. 4. Distinguish between insulators and conductors.
Entry Behaviors	The students are familiar with states of matter.

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGY
Structure of Matters	**STEP I** **Set Induction**	The teacher introduces the lesson by asking the students some question based on their previous lesson on states of matter. He then introduces the topic for the day which is Structure of Matters.	The students listen to the teacher and respond to the teacher's questions and write down the topic of the day.	Questioning,
	STEP II **Select the best Student**	The teacher trains students who are more advanced in a specific skill to serve as tutors to low performing students. The teacher divide the students into group of four using simple random sampling technique.	The students pick their roles as: a)Trained tutors b)Tutees	Organization of peer collaboration
Presentation	**STEP III** **Practicing Unidirectional Peer Tutoring Process**	The teacher present the cardboard paper showing diagrams of the states of matter, he then distributes one note card to each member of the groups identifying each person's role in the group. He also present the photocopies of note on Structure of Matters to the students as: a) Definition of	**Trained Tutors:** The trained tutors distributes photocopies of note of Structure of Matters and asks the students in his group to read the note. The tutor allow the students to read up to a certain point. An eight step process is followed:	Summarize, generalize key strategies and provide feedback.

		molecule, electron and atom. b) Different between positive and negative charges. c) Flow of electricity. d) Different between insulators and conductors.	Read the problem out loud; Listen; Check for the correct response; Praise and encourage; Pause for think-aloud- give tutee time to think; Question-ask helpful and intelligent questions which give clues; Make it real-try to make the problem seem real and related to the tutee life; summarize and generalize key strategies	
Evaluation		The teacher ask the students' questions based on the objectives of the lesson.	The students' attempt the teacher's Questions.	Questioning discussion and exercise.
Conclusion		The teacher monitors the groups, and evaluate the extent at which the objectives have been achieved.		

LESSON 2

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Electromotive force (E.M.F)
Week	Two
Time	
Duration	90 Minutes
Method	**Unidirectional Peer Tutoring Instructional Approach.**
Instructional Materials	cardboard paper showing the diagrams of series and parallel connection of the circuit
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. Define work, power and energy. 2. Differentiate between e.m.f and potential difference (p.d). 3. Identify the application of primary and secondary cells. 4. Draw cells in series, parallel and series- parallel. 5. Test for the condition of a cell or battery.
Entry Behaviors	The students have learned about the structure of matter.

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Electromotive force (E.M.F)	**STEP I** **Set Induction**	The teacher requires the students to mention the processes involved in unidirectional peer tutoring as a peer collaboration strategy.	The students respond to the teacher's questions and write down the topic of the day.	Questioning, examples
	STEP II **Select the best Student**	The teacher trains students who are more advanced in a specific skill to serve as tutors to low performing students. The teacher divide the students into group of four using simple random sampling technique.	The students pick their roles as: a)Trained tutors b)Tutees	Organization of peer collaboration
Presentation	**STEP III** **Practicing Unidirectional Peer Tutoring Process**	The teacher present the cardboard paper showing diagrams of the states of matter, he then distributes one note card to each member of the groups identifying each person's role in the group. He also present the photocopies of note on Electromotive force (EMF) the students as: a) Work , power and energy b) The difference between	**Trained Tutors:** The trained tutors distributes photocopies of note on Electromotive force (EMF) and asks the students in his group to read the note. The tutor allow the students to read up to a certain point. An eight step process is followed: Read the problem out loud; Listen; Check for the correct response;	Summarize, generalize key strategies and provide feedback.

		e.m.f and p.d c) Types of batteries d) Cells e) Series, parallel, series-parallel cell connection.	Praise and encourage; Pause for think-aloud-give tutee time to think; Question-ask helpful and intelligent questions which give clues; Make it real-try to make the problem seem real and related to the tutee life; summarize and generalize key strategies	
Evaluation		The teacher ask the students' questions based on the objectives of the lesson.	The students' attempt the teacher's Questions.	Questioning discussion and exercise.
Conclusion		The teacher monitors the groups, and evaluate the extent at which the objectives have been achieved.		

LESSON 3

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Resistors and capacitors
Week	Three
Time	
Duration	90 Minutes
Method	**Unidirectional Peer Tutoring Instructional Approach**
Instructional Materials	A cardboard paper showing the diagrams and symbols of resistor, capacitor and inductor.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. States the types of resistors, capacitors and inductors 2. State the functions of resistors and capacitors and inductors. 3. Explain the resistors' power rating. 4. State the application of various types of resistor. 5. Identify the working voltage of a capacitor.
Entry Behaviour	The students have learned about Electromotive force (E.M.F)

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Resistors and capacitors	**STEP I** **Set Induction**	The teacher requires the students to mention the processes involved in unidirectional peer tutoring as a peer collaboration strategy.	The students respond to the teacher's questions and write down the topic of the day.	Questioning, examples
	STEP II **Select the best Student**	The teacher trains students who are more advanced in a specific skill to serve as tutors to low performing students. The teacher divide the students into group of four using simple random sampling technique.	The students pick their roles as: a)Trained tutors b)Tutees	Organization of peer collaboration
Presentation	**STEP III** **Practicing Unidirectional Peer Tutoring Process**	The teacher present the cardboard paper showing diagrams of the states of matter, he then distributes one note card to each member of the groups identifying each person's role in the group. He also present the photocopies of note on Resistors and capacitors to the students as: a) Type of resistors, capacitors and indictors. b) Functions of resistors, capacitors and indictors. c) Resistors' power rating. d) Application of various type of resistors.	**Trained Tutors:** The trained tutors distributes photocopies of note on Resistors and capacitors and asks the students in his group to read the note. The tutor allow the students to read up to a certain point. An eight step process is followed: Read the problem out loud; Listen; Check for the correct response; Praise and encourage; Pause for think-aloud-give tutee time to think; Question-ask helpful and	Summarize, generalize key strategies and provide feedback.

			intelligent questions which give clues; Make it real-try to make the problem seem real and related to the tutee life; summarize and generalize key strategies	
Evaluation		The teacher ask the students' questions based on the objectives of the lesson.	The students' attempt the teacher's Questions.	Questioning discussion and exercise.
Conclusion		The teacher monitors the groups, and evaluate the extent at which the objectives have been achieved.		

LESSON 4

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Resistor Colour Coding
Week	Four
Time	
Duration	90 Minutes
Method	**Unidirectional Peer Tutoring Instructional Approach**
Instructional Materials	A cardboard paper showing the diagrams and symbols of resistor, showing their colour codes and values.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. Explain the colourcoding system of resistors and capacitors. 2. Identify the tolerance of resistors and capacitors. 3. State the value of tolerance of any resistor. 4. Calculate the resistance of a resistor using colour codes. 5. Calculate the capacitance of a capacitors using colour codes.
Entry Behavior	The students have learnt about Resistors and capacitors

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Resistor Colour Coding	**STEP I** **Set Induction**	The teacher requires the students to mention the processes involved in unidirectional peer tutoring as a peer collaboration strategy.	The students respond to the teacher's questions and write down the topic of the day.	Questioning, Examples
	STEP II **Select the best Student**	The teacher trains students who are more advanced in a specific skill to serve as tutors to low performing students. The teacher divide the students into group of four using simple random sampling technique.	The students pick their roles as: a)Trained tutors b)Tutees	Organization of peer collaboration
Presentation	**STEP III** **Practicing Unidirectional Peer Tutoring Process**	The teacher present the cardboard paper showing diagrams of the states of matter, he then distributes one note card to each member of the groups identifying each person's role in the group. He also present the photocopies of note on Resistor colour coding to the students as: a) Colour coding system of resistors b) Tolerance of resistors	**Trained Tutors:** The trained tutors distributes photocopies of note on Resistor colourcoding and asks the students in his group to read the note. The tutor allow the students to read up to a certain point. An eight step process is followed: Read the problem out loud; Listen; Check for the correct response;	Summarize, generalize key strategies and provide feedback.

		c) Values and tolerance of resistor d) Calculation of tolerance of resistors through colour codes.	Praise and encourage; Pause for think-aloud-give tutee time to think; Question-ask helpful and intelligent questions which give clues; Make it real-try to make the problem seem real and related to the tutee life; summarize and generalize key strategies	
Evaluation		The teacher ask the students' questions based on the objectives of the lesson.	The students' attempt the teacher's Questions.	Questioning discussion and exercise.
Conclusion		The teacher monitors the groups, and evaluate the extent at which the objectives have been achieved.		

LESSON 5

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Ohm's law and its application
Week	Five
Time	
Duration	90 Minutes
Method	**Unidirectional Peer Tutoring Instructional Approach**
Instructional Materials	A cardboard paper showing diagrams of series and parallel connection of resistor, batteries and capacitor.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. Define ohm's law 2. Calculate resistances, voltage and current using Ohm's law. 3. Draw resistors in series, and parallel connection. 4. Draw Batteries in series and parallel connection. 5. Draw capacitors in series, and parallel connection.
Entry Behaviors	The students were taught about Resistor Colour Coding

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Ohm's law and its application	**STEP I** **Set Induction**	The teacher requires the students to mention the processes involved in unidirectional peer tutoring as a peer collaboration strategy.	The students respond to the teacher's questions and write down the topic of the day.	Questioning, examples
	STEP II **Select the best Students**	The teacher trains students who are more advanced in a specific skill to serve as tutors to low performing students. The teacher divide the students into group of four using simple random sampling technique.	The students pick their roles as: a)Trained tutors b)Tutees	Organization of peer collaboration
Presentation	**STEP III** **Practicing Unidirectional Peer Tutoring Process**	The teacher present the cardboard paper showing diagrams of the states of matter, he then distributes one note card to each member of the groups identifying each person's role in the group. He also present the photocopies of note on Ohm's law and its application to the students as: a) Definition of Ohms' law b) Calculation of resistance, voltage and current using Ohms' law. c) Resistors in series and parallel d) Batteries in series and parallel e) Capacitors in series and parallel	**Trained Tutors:** The trained tutors distributes photocopies of note on Ohm's law and its application and asks the students in his group to read the note. The tutor allows the students to read up to a certain point. An eight step process is followed: Read the problem out loud; Listen; Check for the correct response; Praise and encourage; Pause for think-aloud-give tutee time to think; Question-ask helpful and intelligent	Summarize, generalize key strategies and provide feedback.

			questions which give clues; Make it real-try to make the problem seem real and related to the tutee life; summarize and generalize key strategies	
Evaluation		The teacher ask the students' questions based on the objectives of the lesson.	The students' attempt the teacher's Questions.	Questioning discussion and exercise.
Conclusion		The teacher concludes the lesson by giving the student an assignment to do.		

LESSON 6

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	AC and DC quantities
Week	Six
Time	
Duration	90 Minutes
Method	**Unidirectional Peer Tutoring Instructional Approach.**
Instructional Materials	A cardboard paper showing the difference between AC and DC.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. Explain the difference between AC and DC. 2. Explain the characteristicof alternating current. 3. Define peak value, mean value, and RMS value. 4. Describe the simple treatment of R, L,C in AC circuit. 5. Calculate inductive and capacitive reactance.
Entry Behaviour	The students have learnt about Ohm's law and its application

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Magnetism	**STEP I** **Set Induction**	The teacher requires the students to mention the processes involved in unidirectional peer tutoring as a peer collaboration strategy.	The students respond to the teacher's questions and write down the topic of the day.	Questioning, examples
	STEP II **Select the best Student**	The teacher trains students who are more advanced in a specific skill to serve as tutors to low performing students. The teacher divide the students into group of four using simple random sampling technique.	The students pick their roles as: a)Trained tutors b)Tutees	Organization of peer collaboration
Presentation	**STEP III** **Practicing Unidirectional Peer Tutoring Process**	The teacher present the cardboard paper showing diagrams of the states of matter, he then distributes one note card to each member of the groups identifying each person's role in the group. He also present the photocopies of note on Magnetism to the students as: a) Definition of the concept of magnetism b) The principles	**Trained Tutors:** The trained tutors distributes photocopies of note on Magnetism and asks the students in his group to read the note. The tutor allow the students to read up to a certain point. An eight step process is followed: Read the problem out loud; Listen; Check for the correct	Summarize, generalize key strategies and provide feedback.

		of magnetism c) Laws of magnetic induction d) Types of magnetism e) Properties of magnetism.	response; Praise and encourage; Pause for think-aloud- give tutee time to think; Question-ask helpful and intelligent questions which give clues; Make it real-try to make the problem seem real and related to the tutee life; summarize and generalize key strategies	
Evaluation		The teacher ask the students' questions based on the objectives of the lesson.	The students' attempt the teacher's Questions.	Questioning discussion and exercise.
Conclusion		The teacher concludes the lesson by giving the student an assignment to do.		

LESSON 7

Date

Schools	
Class	NTC I
Subject	Basic electricity
Topic	Principles of transformer
Week	Seven
Time	
Duration	90 Minutes
Method	**Unidirectional Peer Tutoring Instructional Approach**
Instructional Materials	A cardboard paper showing diagrams of transformers and the working principles of a transformer.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1. Explain the concept of magnetism 2. Explain temporary and permanent magnets 3. Explain the concept of law of attraction and repulsion. 4. Explain the types of losses in transformers 5. Mention types of transformer 6. State the uses of each type of transformer.
Entry Behaviour	The students have been taught about AC and DC quantities

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Transformers	**STEP I** **Set Induction**	The teacher requires the students to mention the processes involved in unidirectional peer tutoring as a peer collaboration strategy.	The students respond to the teacher's questions and write down the topic of the day.	Questioning, examples

	STEP II **Select the best Student**	The teacher trains students who are more advanced in a specific skill to serve as tutors to low performing students. The teacher divide the students into group of four using simple random sampling technique.	The students pick their roles as: a)Trained tutors b)Tutees	Organization of peer collaboration
Presentation	**STEP III** **Practicing Unidirectional Peer Tutoring Process**	The teacher present the cardboard paper showing diagrams of the states of matter, he then distributes one note card to each member of the groups identifying each person's role in the group. He also present the photocopies of note on Transformer to the students as: a) Concept of a transformers b) Types of transformers c) Working principles of transformer d) Constructions of transformers.	**Trained Tutors:** The trained tutors distributes photocopies of note on Transformer and asks the students in his group to read the note. The tutor allows the students to read up to a certain point. An eight step process is followed: Read the problem out loud; Listen; Check for the correct response; Praise and encourage; Pause for think-aloud-give tutee time to think; Question-ask helpful and	Summarize, generalize key strategies and provide feedback.

			intelligent questions which give clues; Make it real-try to make the problem seem real and related to the tutee life; summarize and generalize key strategies	
Evaluation		The teacher ask the students' questions based on the objectives of the lesson.	The students' attempt the teacher's Questions.	Questioning discussion and exercise.
Conclusion		The teacher concludes the lesson by giving the student an assignment to do.		

LESSON PLAN 8

Date	
Schools	
Class	NTC I
Subject	Basic electricity
Topic	Electronic signs and symbols
Week	Eight
Time	
Duration	90 Minutes
Method	**Unidirectional Peer Tutoring Instructional Approach**
Instructional Materials	A chart showing Electronic signs and symbols.
Behavioural Objectives	By the end of the lesson, the students should be able to: 1 Draw the symbols of transistor, amplifiers, switch and socket outlet. 2 Describe the function of Ammeter voltmeter 3 Describe the function of multi-meter 4 State how to identify fault using Ohm-meter.
Entry Behaviour	The students were taught about principles of transformer.

INSTRUCTIONAL PROCEDURE

CONTENT	CONTENT DEVELOPMENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	STRATEGIES
Fluxes, Solder and Soldering	**STEP I** **Set Induction**	The teacher requires the students to mention the processes involved in unidirectional peer tutoring as a peer collaboration strategy.	The students respond to the teacher's questions and write down the topic of the day.	Questioning, examples
	STEP II **Select the best Student**	The teacher trains students who are more advanced in a specific skill to serve as tutors to low performing students. The teacher divide the students into group of four using simple random sampling technique.	The students pick their roles as: a)Trained tutors b)Tutees	Organization of peer collaboration
Presentation	**STEP III** **Practicing Unidirectional Peer Tutoring Process**	The teacher present the cardboard paper showing diagrams of the states of matter, he then distributes one note card to each member of the groups identifying each person's role in the group. He also present the photocopies of note on Fluxes, solder and soldering to the students as: a) Concept of soldering b) Types of soldering c) Difference between solder and flux	**Trained Tutors:** The trained tutors distributes photocopies of note on Fluxes, solder and soldering and asks the students in his group to read the note. The tutor allow the students to read up to a certain point. An eight step process is followed: Read the problem out loud; Listen; Check for the correct response; Praise and encourage;	Summarize, generalize key strategies and provide feedback.

		d) Difference between Fluxes for soldering	Pause for think-aloud-give tutee time to think; Question-ask helpful and intelligent questions which give clues; Make it real-try to make the problem seem real and related to the tutee life; summarize and generalize key strategies	
Evaluation		The teacher ask the students' questions based on the objectives of the lesson.	The students' attempt the teacher's Questions.	Questioning discussion and exercise.
Conclusion		The teacher concludes the lesson by giving the student an assignment to do.		

APPENDIX H

BASIC ELECTRICITY ACHIEVEMENT AND RETENTION TEST (BEART)

School: ……..….

Class: NTC I

Time Allowed: 1 hour

GENDER: Male ( ) Female ( )

INSTRUCTION: Attempt all question. Choose the correct answer from the alternative Lettered A-D, circle or tick the letter that bears the option chosen by you.

1. The smallest particle of an element that takes part in a chemical reaction is known as
   A. Atom
   B. Element
   C. Matter
   D. power
2. The device that occupies space and has weight is called
   A. Matter
   B. Atom
   C. Molecule
   D. Electron
3. The unit of measurement of work is
   A. Joules
   B. Amperes
   C. Volt
   D. Watts
4. The voltage measured across a circuit when no current is flowing is termed
   A. Potential difference
   B. Electromotive force
   C. Electromagnetic force
   D. Magneto motive force
5. The unidirectional flow of electrons in a circuit is called
   A. Voltage
   B. Current

C. Resistance

D. Power

6. Which of the following offers very low resistance to the flow of current

A. Ebonite

B. Asbestos

C. Silver

D. Ceramics

7. When capacitors are connected in series, the resultant capacitance value is

A. Higher than the highest capacitance

B. Less than the least capacitance

C. Equal to the highest capacitance

D. Equal to the least capacitance

8. A lamp rated 100w/200v is wrongly connected to a 100v. what would be the power consumption of the lamp under this condition

A. 50w

B. 25w

C. 100w

D. 200w

9. The voltage measured across a circuit when current is flowing is termed

A. Electromotive force

B. Magnetomotive force

C. Potential difference

D. Electromagnetic force

10. Which of these materials is referred to as semiconductor?

A. Copper

B. Diode

C. Nickel

D. Tungsten

11. What is the colour of live terminal of a 13 ampere plug?

A. Black

B. Red

C. Yellow

D. Green

12. The third band of colour coded resistors represents
    A. Tolerance
    B. Second digit
    C. Multiplier
    D. Third digit
13. Calculate the resistance of an immersion heater rated 3kw/240v is
    A. 14.2
    B. 17.2
    C. 19.2
    D. 21.2
14. The following are characteristics of a parallel circuit **except**
    A. The voltage are the same
    B. The current are the same
    C. When one resistor is bad it does not affect others
    D. The resultant resistor value is less than the least value of resistance on the circuit
15. The number of cycles completed in a second in an alternating current is called
    A. Revolution
    B. Hertz
    C. Frequency
    D. Electromotive force
16. The total opposition offered to an a.c current is termed
    A. Resistance
    B. Inductance
    C. Impedance
    D. Capacitance
17. In a purely inductive a.c circuit, the current
    A. Leads the voltage by 90
    B. Lags the voltage by 90
    C. Is in phase with the voltage
    D. Is out of phase with the voltage
18. The power in a.c circuit is calculated using the formula
    A. P=vi

B. P=vicoso

C. P=via

D. P=v2/r

19. The region where magnetic force can be felt is called

A. Magnetic field

B. Magneto motive

C. Magnetic induction

D. Coverage area

20. A transformer with common winding to both primary and secondary is called

A. Single phase transformer

B. Auto transformer

C. Core transformer

D. Three phase transformer

21. A conductor cutting magnetic lines of force will experience an inducement of

A. EMF

B. Potential difference

C. Resistance

D. Capacitance

22. The unit of magnetic flux is

A. Ampere/meter

B. Weber

C. Tesla

D. Ampere

23. The following are types of transformers **except**

A. Current transformer

B. Auto transformer

C. C-core transformer

D. Star transformer

24. The use of diode in construction of a battery charger is to

A. Amplify the output

B. Rectify the output

C. Modify the output

D. Purify the output

25. The following are sources of heat **except**
    A. Electricity
    B. Propane gas
    C. Soldering iron
    D. Paraffin oil
26. The S.I unit of thermal energy is called
    A. Watts
    B. Joule
    C. Newton
    D. Kelvin
27. The unit of measurement of resistance is
    A. Volts
    B. Watts
    C. Ampere
    D. Ohms
28. The function of a capacitor in an a.c circuit is to store electric
    A. Charge
    B. Current
    C. Voltage
    D. Power
29. The polarity of magnet when suspended, point towards
    A. North pole
    B. South pole
    C. East pole
    D. West pole
30. Eddy current loss in a transformer is caused generated due to current flowing in the
    A. Primary winding
    B. Secondary winding
    C. Laminated iron core
    D. Both primary and secondary windings
31. A 240v 50hzA.c transformer has turns in the primary winding. the voltage induced in the secondary winding of 300 turn is

A. 160v

B. 180v

C. 360v

D. 500v

32. The following tools are used in soldering **except**

A. Metal pot and ladle

B. Blow lamp

C. Combination pliers

D. Hammer

33. The value of an inductive reactance is determined using the formula

A. 2π FC

B. 2π FL

C. 2π FR

D. $1/2\pi$FC

34. Which of the following devices has two parallel plates

A. Capacitors
B. Resistors
C. Magnet
D. Cells

35. The positively charged part of an atom is

A. Electron

B. Neutron

C. Daltron

D. Proton

36. The terminal voltage of six primary cells of 1.5v connected in series is

A. 0.25v

B. 1.50v

C. 7.50v

D. 9.0v

37. Rechargeable cells are called

A. Secondary cells

B. Primary cell

C. Tertiary cell

D. Universal cells

38. The function of resistors in d.c circuit is to limit the flow of
    A. Voltage
    B. Current
    C. Electromotive force
    D. Magneto motive force
39. The nucleus of an atom contains
    A. Protons and electrons only
    B. Protons and neutrons only
    C. Electrons only
    D. Neutrons only
40. AC and DC supplies means---------- and ---------- respectively
    A. Alternative current - direct current
    B. Alternating current - direct current
    C. Alternative current - directly current
    D. Alternative current - double current

41. While 'R' is the symbol of a resistor,…… is its unit
    A. Ampere
    B. Ohmmeter
    C. Ohms
    D. Volts

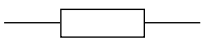
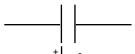
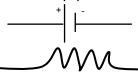
42. Batteries convert mechanical energy to
    A. Electrical Energy
    B. Heat energy
    C. Mechanical energy
    D. Potential energy

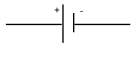
43. Which of the following devices has two parallel plates
    A. Capacitors
    B. Cells
    C. Magnet
    D. Resistor

44. A transformer in which the primary windings are more than the secondary is called
    A. Auto transformer
    B. Double wound transformer
    C. Step down transformer
    D. Step up transformer
45. Region around a magnet in which magnetic force may be detected is known as a
    A. Magnetic area
    B. Magnetic field
    C. Magnetic flux
    D. Magnetic surface
46. The instrument “Ohmmeter” is used for measuring
    A. Current
    B. Power
    C. Resistance
    D. Voltage

47. ……. Is an instrument for measuring voltage
    A. Voltmeter
    B. Wattmeter
    C. Ohmmeter
    D. Ammeter
48. The total E.M.F of four dry-cell batteries connected in series is ……
    A. 1.5v
    B. 3.0v
    C. 9.5v
    D. 6.0v

49. The terminal E.M.F per a dry-cell battery is …….
    A. 1.5v
    B. 1.0v
    C. 1.5w
    D. 1.0w

50. The total opposition to the flow of alternating current in a circuit is called
    A. Conductance
    B. Impedance
    C. Reluctance
    D. Resistance
51. The resistance of three resistors value 2′Ω, 4′Ω, and 8′Ω when connected in series is?
    A. 0.88
    B. 1.14
    C. 14.00
    D. 16.00
52. The resistor 2′Ω, 3′Ωand 5′Ω are connected in parallel. If the supply voltage is 50v, what is the current in 3′Ω resistor?
    A. 16.7VA
    B. 2A
    C. 3.3VA
    D. 5A
53. The maximum negative value of a sine wave alternating voltage is
    A. 90
    B. 180
    C. 270
    D. 360
54. Mathematical expression of Ohm's law is given by
    A. F=Q1Q2r2/K
    B. I=V/R
    C. P=VI
    D. H=Q/t
55. A permeable substance is one
    A. Through which the magnetic lines of forces can pass very easily
    B. Which is a bad conductor
    C. Which is a good conductor
    D. Which is a strong magnet
56. …….. symbolizes a capacitor
    A. 
    B. 
    C. 
    D. 
57. The circuit diagram below describes……..

    A. Three resistors in series
    B. A resistor, an inductor, and a capacitor in series
    C. A resistor, a capacitor, and an inductor in series
    D. A diode, a capacitor, and an inductor in series
58. The symbol bellow indicates 
    A. Battery
    B. Capacitor

C. Cell
D. Resistor

59. The function of a capacitor in an A.C circuit is to store electric
A. Charge
B. Current
C. Power
D. Voltage

60. ……. Is an instrument for measuring voltage

A. Voltmeter

B. Wattmeter

C. Ohmmeter

D. Ammeter

APPENDIX I

MARKING SCHEME FOR BASIC ELECTRICITY ACHIEVEMENT AND RETENTION TEST (BEART)

1. A
2. A
3. A
4. B
5. B
6. C
7. B
8. B
9. C
10. B
11. B
12. C
13. C
14. B
15. A
16. C
17. B
18. A
19. A
20. B
21. A
22. B
23. C
24. B
25. D
26. A
27. D
28. A
29. A
30. C
31. B
32. A
33. B
34. D
35. D
36. D
37. A
38. B
39. C
40. B
41. C
42. A
43. A
44. C
45. B
46. C
47. A
48. D
49. A
50. B
51. C
52. A
53. C
54. B
55. A
56. B
57. A
58. A
59. B
60. A

APPENDIX J

BASIC ELECTRICITY INTEREST INVENTORY (BEII)

Dear Student,

Below are the list of items made to investigate the degree of student's Interest in Basic Electricity. You are require to rate yourself to Indicate the degree to which items are representative of you; you should be sincere in your rating.

Name of school: ----------

Gender: ----------

*****Note:

S A: Strongly Agree

A: Agree

D: Disagree

SD: Strongly Disagree.

S/N	ITEMS	SA	A	D	SD
1	I pay good attention in Basic Electricity classes				
2	I enjoy participating in Basic Electricity lessons				
3	I often have the time to visit Basic Electricity workshop				
4	Basic Electricity subject is simple to understand				
5	Basic Electricity classes are very interesting				
6	Basic Electricity periods are always boring to me				
7	I attended Basic Electricity classes regularly				
8	It is better to use Basic Electricity periods for other subjects				
9	I like all the formulas and calculations in Basic Electricity				
10	I like doing assignments on Basic Electricity subjects				
11	I always feel sleepy during Basic Electricity lessons				
12	Basic Electricity periods should be extended to 4hrs				
13	I don't use to ask question during Basic Electricity classes				
14	I like to know the names of the different tools and testing equipment's used in Basic Electricity practical				
15	Basic Electricity classes increase my interest in electricity work				
16	I take interest in studying Basic Electricity parts and system				
17	I do volunteer to invite Basic Electricity teacher whenever it is time for his lesson				

18	Basic Electricity trade was not my choice				
19	I like teaching my friends Basic Electricity				
20	I always copy note during Basic Electricity lesson				
21	I use to be happy when our Basic Electricity teacher is absent from class				
22	I usually complete my Basic Electricity assignment on time				
23	I do extra studies on Basic Electricity apart from the normal lessons				
24	I enjoy reading books on Basic Electricity				
25	I encourage my colleagues to develop interest in Basic Electricity				
26	I like solving past question papers of Basic Electricity on my own				
27	In a group work I prefer recording results instead of participating in the actual task				
28	I like to work in a Basic Electricity industry after my graduation.				
29	Basic Electricity subjects are difficult to understand				
30	I like putting on my overall during practical				

APPENDIX K

TRAINING MANUAL ON BIDIRECTIONAL AND UNIDIRECTIONAL PEER TUTORING

Purpose of the Manual

The purpose of this manual is to assist Basic Electricity teachers used in this study to plan and implement the bidirectional and unidirectional peer tutoring instructional approaches in the topics Structure of matter and its relevance to electricity, chemical sources of electromotive force, resistors, capacitors and inductors, values and functions of resistors, the values of resistor (s), ohm's law and its application, Distinguish between AC and DC quantities, principles of transformers, its construction and operation, electronic sign and symbols, taught to NTC I students. The peer tutoring instructional approaches improves learner's academic achievement and retention and also helps in developing student's skills, provides a way for all students to partner with one another by linking high achieving students with lower achieving students or those with comparable achievement to enriched themselves academically and used to cover a large amount of material quickly.

Aim of the manual

The aim of the manual is to guide the Basic Electricity teachers who will teach using peer tutoring instructional approaches lesson plans. The lesson plans consist of related skills and instructional procedures required for training students in Basic Electricity using peer tutoring instructional approaches. Each lesson plan comprises of the following areas:

1. Module: this is the area specified in NBTE syllabus to be taught by the teacher before the goal of providing students with knowledge and skills that will enable them understand Structure of matter and its relevance to electricity, chemical sources of electromotive force, resistors, capacitors and inductors, values and functions of resistors, the values of resistor (s), ohm's law and its application, Distinguish between

AC and DC quantities, principles of transformers, its construction and operation, electronic sign and symbols.

2. Topic: these are the contents or subject matter dealt with in the module
3. Duration: this is the period of time per lesson
4. Previous Knowledge: this the knowledge or experience the students brought into the classroom that is relevant to the topic to be taught by the teacher
5. Specific instructional objectives: that is, the knowledge to be gained or skills to be acquired by the students after teaching.
6. Entry behaviours: this describes the behaviours that students brought into the classroom before the commencement of class activities or teaching
7. Content: that is, a breakdown of the subject into smaller separate units, to enable the students deal with the topics step by step.
8. Teachers' activities: that is, those things that the teacher can do in terms of specific activities that will facilitate how students understand what they are being taught. The performance of these activities by the teachers will also lead to the achievement of objectives.
9. Students' activities: these are activities to be performed by the students that will lead to achievement of the objectives. By performing these activities students will be able to gain knowledge or acquire skills as stated in the objectives

Training:

(1) Study the module and lesson plans carefully

(2) Prepare thoroughly in advance, the students learning activities, by getting all the materials students will need for performing the activities ready and setting the stage for the student's activities.

(3) Prepare for your own roles which includes; guiding the students step-by-step to work towards achieving the objectives.

Assessment

Assess students activities as the lesson goes on, as they perform the activities and at the end of the lesson.

APPENDIX L

A 60 ITEMS TABLE OF SPECIFICATION FOR BASIC ELECTRICITY COGNITIVE ACHIEVEMENT AND RETENTION TEST

Cognitive levels									
S/N	Topics	Percentage (%)	Knowledge (21.7 %)	Comprehension (23.3%)	Application (18.3 %)	Analysis (16.7%)	Synthesis (8.3 %)	Evaluation (11.7 %)	Total questions.
1	Structure of Matter	16.7	3	2	1	1	1	2	10
2	Ohm's law and its application	15	2	2	2	1	1	1	9
3	Resistors and Capacitors	13.3	2	1	2	1	1	1	8
4	Resistor colour coding	10	1	2	1	1	-	1	6
5	Electro motive force	10	1	2	1	1	-	1	6
6	Magnetism	13.3	2	1	1	3	1	-	8
7	Transformer	10	1	2	1	1	-	1	6
8	Fluxes, solder and soldering	11.7	1	2	2	1	1	-	7
	TOTAL	**100%**	**13**	**14**	**11**	**10**	**5**	**7**	**60**

Source Researcher

APPENDIX M

KUDER-RICHARDSON 21 TEST RESULT FOR BASIC ELECTRICITY COGNITIVE ACHIEVEMENT AND RETENTION TEST

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

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

Reliability Statistics

Kuder-Richardson 21	N of Items
.793	60

APPENDIX N

CRONBACH'S ALPHA CORRELATION TEST RESULT FOR BASIC ELECTRICITY INTEREST INVENTORY

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

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

Reliability Statistics

Cronbach's Alpha	N of Items
.831	30