CHAPTER ONE

INTRODUCTION

Background to the Study

In a developing country like Nigeria, there is need for efficient and well trained individuals who would be able to cater for themselves and participate productively in the development of the society. From the ancient societies to modern nations, education proved to be the most potent tool for survival, growth and development. Agbatogun (2010) conceived education as a systematic action of imparting knowledge, skills and habits to the learners in their preparation for meaningful life and contribution to better society.

According to Lawal(2013), education is the act of giving knowledge to or developing the abilities of people by teaching, training or schooling.It is an instrument for helping both individuals and society to re-orient themselves towards more positive beneficial and more productive services.Eze (2013) affirmed that education,particularly technicalvocational education and training is a veritable tool for achieving the much needed economic and technological development. It is a fulcrum on which all other developmental facets are hinged.

Technical Vocational Education and Training is the process of acquiring knowledge, skills, attitudes, interests, abilities, competences, and norms of a society by people to enhance perpetual development. In order to achieve this, the individual is exposed to different learning experiences ranging from individual's culture, polity, knowledge, management, partnership, negotiation,

communication to information technology skill. It is in recognition of the importance of education that Nigeria has continued to make serious efforts towards providing the citizens with quality and functional educations for social, economic and political development.In making effort towards qualitative and functional education, the Federal Government of Nigeria(2013) in her National Policy on Education stated that one of the aims and objectives of education in Nigeria is to help the child acquire appropriate productive skills, abilities and competencies, both mental and physical as equipment for the individual to live and contribute to the development of the society. These skills, abilities and concepts could be acquired through the training provided in schools and colleges.

The implication of all these for teachers is that they should develop and employ learning approaches which should encourage learners to participate actively in the learning processes. Teachers are to promote learning methods which bring about interaction among students and improve on their relationship with individuals in the classroom.Igboko and Ibeneme (2006) pointed out that traditional education practices such as demonstration and lecture methods alone have proved incapable of producing skills required for coping with the challenges posed by rapid technological development. Igboko and Ibeneme noted that teachers are strongly encouraged to use the students' activity-based and inquiry mode, involving substantial workshop activities in teaching to

ensure achievement and retention of concepts in technology. One of the suchmethods in this regard is cooperativelearning.

Cooperative Learning refers to instructional method in which pair or small group of learners with different levels of ability work together to accomplish a shared goal (Iqbal, 2004). In the view of Amita, (2006), cooperative learning refers to a situation where a small dedicated group of students learn together and take advantages of each other's expertise to achieve a common goal.Mckeachie (2009) explained that in a cooperative learning class, students often elaborate on the concept being taught to achieve what is expected. Elaborations not only enhance the learning of students who receive the explanation but could also deepen the understanding of the student providing the explanation.

Cooperative learning comprises instructional method in which teachers organize the students into small groups which then work together to help one another learn some academic content (Slavin, 2011). It is a kind of learning method in which students study together and complete goals. Each student contributes in small groups to promote all students achievement. Slavin, (2011) posited that it could produce positive effect on student academic achievement and retention.

Academic achievement is defined as learning outcomes of the student in terms of level of skills, knowledge and ideas necessary for gainful employment in related occupations (Epunam, 2009). According to Epunam, academic

achievement connotes performance in a school subject as symbolized by scores in an achievement test.

Academic achievement is the extent to which a student, teacher or institution has achieved their short or long term goal (Alaba, 2010). Academic achievement is a permanent change in the conceptual attainment of knowledge, skill and attitude of the learner on the completion of a specified course of study or module.Spinath (2012) opined that academic achievement represents outcome that indicates the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in schools. It is described as the outcome of students' effort in examinations. It could be high, average or low or poor. Abdullahi (2013) described poor academic achievement as any performance that falls below a prescribe standard. The classroom teacher is therefore faced with the challenge of teaching to attain effective conceptual change, high academic and skill achievement. Learning indeed occupies a very important place in one's life. It is the basis of human survival as well as the development and progress of society.

However, the best efforts in learning may turn into a futile exercise, if the products of learning are not utilized at a later stage by the learner. For making use of material learnt it must remain in the learner's mind, stored up somehow, to be used when the need arises. This process is called retention. Retention of learning according to Ausubel and Robinson (2002) is the repeated performance of behaviour earlier acquired by the learner and elicited after an interval of time.

Retention can therefore be described as the ability of a learner to recall to memory facts and figures in learning experiences. Retention can also be seen as someone's ability to keep and recall past experiences or recognize what has been learned or experienced from memory.This implies that a learner who repeats an acquired piece of knowledge with less error is said to have retained the material learnt.Demmart (2001) noted that retention is affected by the degree of original learning, reinforcement, learners' memory capacity and method of learning which could be passive and participatory(active). Shrun and Glinson (2001) contended that learning occurs often when student put more effort and attention in the learning process thereby being active learner. On the other hand, students do not learn or retain information when they are passive learners, which may lead to learning by memorization.

Further, Houghton (2007) defined retention as the ability of the mind to remember information acquired from reading, observation or other processes. In the world of psychology this ability or power of the mind to store the past experiences of learning and utilizing them at a later stage is known as 'memory' (Mckeachie, 2007). According to Mckeachie, memory or the process of memorization is quite a complex process which involves factors like learning, retention, recall and recognition.

The preservation of memory traces by the central nervous system or brain is known as retaining of the learned or experienced act. How long one can retain depends upon the strength and quality of the memory traces. Retention is the

amount of what the learner has retained about the learnt material equals amount the learner originally learned less the amount forgotten.(Zain, Subramaniam, Rashid &Ghani, 2009).According to Dancis, (2009) students learn and retain more when they develop their own knowledge and meaning from their own experiences. According to Safo, Ezenwa and Wushishi (2013) retention is the ability to keep or retain the knowledge of what is learnt and be able to recall it when it is required. Retention in this work can be explained as the ability to recall or remember what has been taught after a given time.

This holds that learning is build upon knowledge that a student already has and learning is more effective when student are actively engaged in the learning process rather than attempting to receive knowledge passively. To this end, Moore(2008) noted that activity-based teaching method such as cooperative learning method which is learner centered may reverse the difference in academic achievementexisting between low and high achieving students. Hall (2002) opined that since activity based teaching encourages students to work cooperatively in groups or individually to exploit the available resources for learning, the gap between high and low achieving student could be bridged.

Retention with research to technology means that a student has as an ability to recall or recognize the basic technology concepts which have been learned before. Technology involves the academic and practical study of materials, source of energy and natural phenomena with the ultimate intention

of applying these to the service of man to make life more comfortable (Bamiro, Nurudeen&Akuru 2014). It is a major determinant of economy growth in the country.

Basic Technology (encapsulated in technology education) is a compulsory subject in the Nine Year Basic Education programme. Its purpose is to contribute to the achievement of the national education goals by inculcation of technology literacy, that is, basic understanding of and capability in technology, exposure of students to the world of work to match their talents and interests for wise vocational choice; and inculcation of positive attitudes towards work as a source of human identity, livelihood and power (National Education Research Development Council, NERDC, 2007).

The aim of Basic Technology is to introduce students to technology right at the beginning of their junior secondary school level. The typical junior secondary Basic Technology curriculum consists of various topics, for the purpose of this study the following are captured thus: You and Technology, Safety, Material and Processing, Drawing Practice, Tools and Machines, Applied Electricity and Electronics, Energy and Power, Maintenance and Building.

The quality of basic technology teaching and learning in junior secondary school has a great influence and motivation on the achievements of students at the senior secondary or technical college. The effective teaching and learning of Basic Technology will expose students to the world of work and eventually

qualify them to proceed to higher educational level so that they could become middle level manpower who are knowledgeable in the field of technology and who possess the skills and ability to solve societal problems. Basic Technology students are therefore expected to have competencies in technology including the ability to develop functional knowledge of basic technology concepts and principles, observe and explore the technological environment, apply the skills and knowledge gained through the study of Basic Technology to solve day to day problem, develop scientific and technological attitudes such as curiosity and precision, manipulate simple tools for the purpose of demonstrating processes, andimprovise simple equipment or machine from available resources in the immediate environment to solve societal problems (Federal Republic of Nigeria (FRN, 2013).

Achieving these competencies therefore means that every student must be taught the basic technology so as to understand and master all the concepts in the Junior Secondary School Curriculum. The junior secondary schoolsend with final external examination, which is normally conducted by National Examination Council (NECO) or State Ministry of Education. Students register for the two external examinations or either as the case may be.

Despite the plan and efforts of the government to improve science and technology education at all levels of education, the achievements of students in basic technology have not been encouraging. The outcomes of internal and external examinations of student in junior secondary schools have revealed a

decline in the achievement level in basic technology. This drastic fall in the academic achievement level in Basic Technology in Oyo state between year2010 and 2015 (see Appendix Q, page 182)is traceable to many psychological and environmental factors, which could be governmental, institutional, parental and societal factors (Garba, 2012). These factors could be as a result of government's poor attitude towards revitalization of basic institutions in Nigeria, parent perception on education, lack of qualified technology teachers, student poor reading habits, and poor societal attitudes in embracing basic technology. Gender and location has been reported among the factors that affect students' academic achievement and retention. Notwithstanding, FRN (2013) provides for equal education opportunity for all citizens, male and female to study all the subjects.

Gender is a term which describes behaviour and attributes of individuals on the basis of being either a male or female in a given society (Uwameiye&Osunde, 2005). Students' gender may have effect on academic achievement in basic technology. According to Okeke (2008) there are many challenges posed by gender on academic achievement of students where certain subject and activities are seen as masculine and other as feminine. According to Abubakar and Uboh (2010), gender distinguishes organism on the basis of their reproductive roles as female and male. Studies on gender differences on academic achievement have presented mixed result. The belief that males perform better than the females in technical subjects is being debunked by

recent studies(Abubakar 2010; Eniayeju 2010).The above views indicated that there are needs to re-examine the method of impartingthe concept of basic technology to the students,so thatthe acquired knowledge would assiststudents to solve the day-to-day problemsinreal life situation. Theclassroom teacher is therefore faced with the challenge of teaching to attain effective conceptual change, high academic and skill achievement. Hence the researcher intends to find out the effects of cooperative leaning method (CLM) on academic achievement and retention of students in basic technology in Oyo State.

Statement of the Problem

Many students turn out to be very miserable and inattentive in a Basic Technology class after being taught a concept and discovering they could not memorize or recall such a concept with ease. The reasonsfor this difficulty vary but could sometimes be traced to the teaching method used to explain such concepts. There are opinions that associated poor academic achievement of studentsto poor method and approaches to teaching, lack of instructional materials and wrong method of teaching, which is teacher-centred and often creates frustration, learning difficulties and do not encourage active participation of students. The traditional or conventional methodsprobably do not sufficiently give students the opportunity to participate in the classroom activities and as such students do not adequately acquire skills and knowledge required.

However, these methods do not seem to be yielding the expected results currently.There is observable declining trend in the academic achievementinBasic Technology by Junior Secondary studentsin public examinations such asNational Examination Council (NECO) and Basic Examination organized by Federal Ministry of Education (FME) for Junior Secondary School Three (JSSIII) Students.

Between 2011 and 2015,35%of students out of those whosat for Basic Technology external examination passed at credit level in Oyo State. Could this poor academicachievement be traceable to inappropriate method of teachingBasicTechnology.There are opinions that student-centred methods could improve students' academic achievement much more than conventional methods.

Based on the above view, there is therefore, the need to carry out a study on an innovative and participatory teaching method where students are helped to become active rather than passive learners. One of the teaching methods proposed that could produce positive effects on students' academic achievement and retention is cooperative learning method. It is on this basis, that the study was conceived to determine the effects of cooperative learning method on academic achievement and retention of students' in Basic Technology when compared with conventional teaching method.

Purpose of the Study

The main purpose of the study was to determine the effects of cooperative learning methodonthe academic achievement and retention of students inBasic Technology. Specifically, the studydetermined the:

1. pre-test and post-test achievementmeanscores of students taught Basic Technology using cooperative learning method and those taught usingconventional teaching method.

2. academic retentionmean scores of students taught Basic Technology using cooperative learning method and those taught using conventional teaching method.

3. pre-test and post-test academicmean scores of high and low performing students taught Basic Technology using cooperative learning method.

4. retentionmean scores of male and female students taught Basic Technology using cooperative learning method.

5. interaction effects of teaching methodsand gender on students' academic achievement in Basic Technology.

Significance of the Study

Findings of this study will be of immense benefits tostudents of Basic Technology teachers, school guidance and counselor, school administrators,curriculum plannersand future educational researchers and the society at large.

Findingsof this study will be of benefit to theBasic Technology students since it will allowfor active involvement and participation of students in the teaching and learning process.It could enhance their academic achievement and help them to retain more knowledge of Basic Technology and also utilize to them solve societal problems and also used for further education advancement.

Basic Technology teacherscould effectively employ the method in passing on the subject concepts tostudents both the weak, average and fast learners.

School guidance and counselorscould also benefit from the result of the findings, in the sense that, when effective teaching method established in the learning of Basic Technology and enhances academic achievement of students,it could assist to diagnose, determine, prescribe and recommend appropriate placement or career choice to the Basic Technology students as a prospective technology educator.

The findings of this study will be of benefit to the school administrators, in the sense that the knowledge gained from the study could guide them to procure the relative and adequate curriculum and instructional materials to actualize teaching and learning of Basic Technology concepts through the activity-based teaching method.

The outcome of this study will be of benefit to the curriculum plannerssince the knowledge gained from the study could provide more insight for the Basic Technology curriculum planners, in taking appropriate decision,

towards reassessment of curriculum and encouraging re-evaluation of Basic Technology instructional delivery method by emphasizing the use of effective teaching method for teaching Basic Technology and other technology subjects at post basic level of education.

The findings of this study will be of benefit to school administrators in that the knowledge gained from the study could guide them to encourage the teachers to attend seminars and workshops on cooperative leaning methoddue to its efficacy and enhancement in academic achievement and knowledge retention.

Scope of the Study

The study was delimited to junior secondary school 2016/2017(JSS 2) students in three educational zone in Oyo state,and key concepts in Basic Technology for JSS2 syllabus, topics covered were: you and technology, safety, material and processing, drawing practice, tools and machines, applied electricity and electronics, energy and power; maintenance and building.

Research Questions

The following research questions guided the study:

1. What is theeffectof cooperative learning method (CLM) on academicachievement of students taught basic technology when compared with those taughtwith conventional teachingmethod (CTM) using their pretest and post test scores?.

2. What is the effecton the academic retention meanscores of students taught basic technology usingcooperative learning method and those taught usingconventional teaching method using their post-test and delayed post-test mean scores?

3. What is theeffect of cooperative learning method on academic achievement of high and low achieverstaught basic technology using their pre-test and post-test scores?

4. What is the effect of cooperative learning methodon the retention of male and female students in basic technology using their post-test and delayed post-test means scores?

5. What are the interaction effects of teaching methodsand gender on students' academic achievement in basic technology?

Research Hypotheses

The following null hypotheses were tested at 0.05 level of significance

1. There is no significant difference between thepost-test academicachievementmean scores of students taught basic technology using cooperative learning method and those taught usingconventional teaching method
2. There is no significant difference between theretention mean scores of students taught basic technology usingcooperative learning method and those taught usingconventional teaching method.
3. There is no significant difference between the pre-test and post-test academic achievementmean scores of high and low performing students taught basic technology using cooperative learning method.
4. There is no significant difference between theretentionmean scores of male and femalestudents taught basic technology using cooperative learning method.
5. There is no significant interaction effect of the teaching methodsand gender on students' academic achievement in basic technology.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviewed the literature related to the study under the following sub-headings:

Conceptual Framework

Conventional or Traditional Method of Teaching

Cooperative Learning Method

Academic Achievement

Knowledge Retention

Basic Technology

Theoretical Framework

Socio Cultural Theory

Piaget Theory of 1973

Theoretical Studies

Secondary Education in Nigeria

Teaching and Instructional Learning Methods

History and typesof Cooperative Learning Method

Effects of cooperative learning method on Academic achievement

Implementation and benefits of cooperative Learning Method

Gender Issues In Technology Education

Factors Affecting Students Academic Achievement and Knowledge Retention

Related Empirical Studies

Effects of Cooperative Learning Method on Students' Academic Achievement in Basic Technology

Effects of Other Teaching Methods on Students' Academic Achievement and Knowledge Retention

Gender issues and Students' Academic Achievement

Summary of Review of RelatedLiterature

Conceptual Framework

Relevant concepts in this study were reviewed in this section as follows:

Conventional orTraditional Method of Teaching

Conventional or Traditional Method of Teaching is when a teacher directs students to learn through memorization and recitation techniques thereby not developing their critical thinking problem solving and decision making skills (Anang, 2013) while modern or constructivist approach to teaching involves a more interacting student. Conventional or Traditional slightly sophisticated teacher-centered methods rather than modern student-oriented applications and techniques while the transmission of knowledge and information has been realized with the usual form of lectures or discussions requiring physical presence of both student and the teacher. Furthermore the teaching methods used may differ in terms of the degree of influence on active learning (Cottel& Millis, 1993; Bonner, 1999).

Active learning involves students and helps them to have an in-depth understanding of the course, through induction of practice; in other words, the

inductive teaching has better result than productive teaching (Adler, 1999). Moreover, it has been argued that inductive methods increase the consolidation and conservation of a subject as well as the assessment and evaluation of achievement with better subsequent future career paths for students studying a given subject from a book (Kelley et al., 1999).

Gage, Edmund and Ryan cited Anang (2013) conventional or traditional teaching is a form of interpersonal influence aimed at changing the behavior potential of another person primarily involving classroom talk which takes place between teacher and pupil and occurs during certain definable activity. It is concerned with the activities of guidance or direction of the learner.

Cooperative Learning Method

Cooperative learning methodis however defined as “a small group of individuals working jointly to solve problems and complete task” a cooperative model needs student goal, reward, interdependence and cooperation in all types of matters (Johnson, Johnson &Stanne 2006)**.** Several definitions of cooperative learning have been rendered.

Johnson, Johnson and Stanne described cooperative learning as an instructional method that makes use of small heterogeneous groups of students who work together to achieve common learning goals. Cooperative learning is an approach to group work that minimizes the occurrence of those unpleasant situations, such as but maximizes the learning and satisfaction that result from working on a high-achievement team. According to Woolfolk(2001),

cooperative learning is an arrangement in which students work in mixed ability groups and are rewarded on the basis of the success of the groups. Cooperative learning is different from an ordinary group work. Where students, work together without any defined ruleswithout involving cooperation which is the basic ingredient of cooperative learning.Iqbal(2004) defined cooperative learning as a sensible or insensible behavior of living organism for joint survival. According to Macpherson (2007) cooperative learning is part of a group of teaching or learning techniques where students interact with each other to acquire andpractise the elements of a subject matter and meet common learning goals. It is much more than just putting students into groups and hoping for the best.Mckeachie (2009) explained that in a cooperative learning class, students often elaborate on the concept being taught to achieve what is expected. Elaborations not only enhances the learning of students who receive the explanation but could also deepen the understanding of the students providing the explanation.

Cooperative learning comprises instructional method in which teachers organize the students into small groups which then work together to help one another learn some academic content (Slavin, 2011). It is a kind of learning method in which students study together and complete goals. Each student makes effort in small groups to promote all students achievement. Slavin, posited thatcooperative learning could produce positive effect on student academic achievement and retention.

Liaquat, Asif, Qayyum and Muhammad (2014) defined cooperative learning as a social activity which gives mutual benefit to all participants. In thecontext of this study, cooperative learning method is an activity-based approach where students withmixed academic ability levels work together to achieve a common goal.

Academic achievement

Alaba (2010), viewed that varieties of learner achievement are made possible by different learning capabilities. Academic achievement is a permanent change in the conceptual attainment of knowledge, skill and attitude of the learner on the completion of a specified course of study or module.According to Alaba, academic achievement is attitudinal exhibition an individual does or achieves in class, workshop, laboratory, library or field of work at school, college or university. Emaikwu (2012) posited that academic achievement vary significantly when lecture, discussion and activity-based methods used and that it measures students' success in educational institution or how well they meet standard set by institutions or examining bodies.

Academic achievement is defined as the outcome of the extent to which a student, teacher or institution has achieved their educational goal. In the context of this study,academic achievement is the outcome of students' effort or achievement in a specify test or examination. Academic achievementare commonly measured by examinations or continuous assessment but there is no

general agreement on how it has been tested or which aspect are most important(Spinath2012).

The implication of all these for the classroom teachers is that teachers especially in the junior secondary school should develop and employ learning approaches which should encourage learners to participate actively in the learning processes.

Knowledge Retention

Retention is defined by Kundu and Tutoo(2002) as a preservative factor of the mind. The mind acquires the materials of knowledge through sensation and perception. These acquired materials in the mind need to be preserved in form of images for knowledge to develop. Whenever a stimulating situation occurs, retained images are revived or reproduced to make memorization possible. Retention according to Ausubel and Robinson (2002) is the process of maintaining a replica of the acquired new meaning or some part of it.

Retention can be described as the ability of a learner to keep memories about facts and figures in learning experiences. Retention can also be seen as someone's ability to recall past experiences or recognize what has been learned or experienced from memory. Houghton (2007) defined retention as the ability of the mind to remember information acquired from reading, observation or other processes. In the world of psychology, this ability or power of the mind to store the past experiences of learning and utilizing them at a later stage is known as "memory" (Mckeachie, 2007). According to Mckeachie, memory or

the process of memorization is quite a complex process which involves factors like learning, retention, recall and recognition. Retention means that someone has an ability to recall or recognize the basic which have been learned before.

The preservation of memory traces by the central nervous system or brain is known as retaining of the learned or experienced act. How long one can retain depends on the strength and quality of the memory traces. Retention is the amount the learner has retained about the learnt material equals amount the learner originally learned less the amount forgotten. (Kara 2008).According to Safo, Ezenwa and Wushishi (2013) retention is the ability to keep or recall the knowledge of what is learnt and be able to give it out when it is required.In this study retention is the repeat of academicachievement by a learner or behavior earlier acquired, elicited after an interval of time. This implies that a learner who repeats an acquired piece of knowledge with less error is said to have retained the material learnt.

Basic Technology

Basic Technology is a compulsory subject in the Nine (9) Year Basic Education Programme. Its purpose is to contribute to the achievement of the national education goals by: (i) inculcation of technological literacy that is, basic understanding of, and capability in technology. (ii) exposing students to the world of work to match their talents and interests for wise vocational choice; and (iii) inculcation of positive attitudes towards work as a source of human

identity, livelihood and power.(Nigerian Educational Research and Development Council (NERDC),2007).

Basic Technology is based on the understanding that in a world increasingly driven by technology, it would be a disaster for any person or society not to inculcate basic technology skills. The responsibility of every nation and every school is to provide opportunities for all to acquire technological literacy. This is in line with the current goals of the National Economic Empowerment and Development methods (NEEDS) (NERDC, 2007).

In pursuit of its objectives, the revised curriculum covers the following nine (9) themes:

- You and Technology
- Safety
- Materials and Processing
- Drawing Practice
- Tools and Machines
- Applied Electricity and Electronics
- Energy and Power
- Maintenance
- Building

The contents under each theme are made to reflect the basic nature of technology, i.e. knowledge, skill, creativity and attitude. (NERDC, 2007)

Theoretical Framework

Two theories that are related to this study were reviewed as follows**:**

Socio-Cultural Theory

The Socio- cultural theory was propounded by Vygotsky in 1978.The theorystates that knowledge is socially constructed and learning develops as a result of dialogical and dialectical interaction between teachers (facilitators) and students and between students.

Vygotsky as a social cognitive theorist also suggested that collaborative learning is beneficial to the people involved. A Vygotskian belief is that instead of assessing student by means of standardized tests, we assess them by comparing what students are capable of doing individually with what they have the ability to do with the help of an individual who has previously mastered the concept at hand. Skill is more important than age; thus, the tutor should be at a higher level than the tutee. Vygotsky affirmed that students helping students in academic and social interaction in general, will provide growth for students. Many available studies on cooperative learning were based on Vygotskian's theory. In order to gain an understanding of Vygotsky's theory on cognitive development, one must understanding two of the main principles of Vygotsky'swork: the More Knowledgeable Order (MKO) and the Zone of Proximal Development (ZPD). The more knowledgeable other (MKO) refers to someone who has a better understanding or a higher ability level than the learner, with respect to a particular task, process, or concept while zone of

proximal development is seen to be the area where the most sensitive instruction or guidance should be given, allowing the child to develop skills they will then use on their own, developing higher mental functions. Vygotsky also views interaction with peers as an effective way of developing skills and methods. Vygotsky suggests that teachers use cooperative learning exercises where less competent children develop with help from more skillful peers within the zone of proximal development.

This theory provides the basis for social interaction among the students which in turn could lead to assimilation, retention and improved achievement in the subject area. Vygotskian theory therefore has a particular relevance to this study;Cooperative Learning Method (CLM) and provides the necessary assistance for students learning, interaction, and the construction of knowledge to effectively take place.

Jean Piaget Theory of Cognitive Development

Jean Piaget propounded the theory of cognitive development in 1973. The theory states thatsocial interaction promotes cognitive growth in people. Children's relationship with their peers are different from those with adults; peer relationships are cooperative and allow for potential cognitive change, while adult-child relationships are dominated by the adult and do not allow questioning, which diminished understanding. Piaget thought that the lecture, even demonstration, method was not the most effective teaching method unless students were also able to discover their own ways to learn. Jean Piaget felt

there should be freedom and initiative built into teacher training which would give instructors the opportunity to focus more on student interaction and learning rather than on teaching.

The main difference between Vygotskian and Piagetian theories: is that Piaget states that peers need to be equal in age while Vygotsky stresses the importance of having a tutor that is more competent than the tutee, Vygotsky states that cognitive development stems from social interactions from guided learning within the zone of proximal development as children and their partners construct knowledge. In contrast, Piaget maintains that cognitive development stems largely from independent explorations in which students construct knowledge on their own. This theory is related to the study based of the fact that the students teaching themselves would bring about development in their cognition and gaining experiences among themselves through exchange of ideas in the course of teaching and learning.

Theoretical studies

Theoretical studies related to the present study were reviewed under the following headings:

Secondary School Education in Nigeria

Garba(2012) posited that, Secondary education is of six-year duration and given in two stages, junior and senior levels of three years each. Secondary education completes the provision of basic education that began at primary

level, and aims at laying the foundations for lifelong learning and human development, by offering more subject or skill-oriented instruction.

According to FRN (2013) Secondary education is the form of education children receive after primary education and before the tertiary stage. The broad aims of secondary education are:

(i) Preparation for useful living within the society and

(ii) Preparation for higher education.

In specific terms the secondary school should:

(i) provide an increasing number of primary school pupils with the opportunity for education of a higher quality, irrespective of sex, social, religious, and ethnic background;

(ii) diversify its curriculum to cater for the differences in talents, opportunities and roles possessed by or open to students after their secondary school course;

(iii) equip students to live effectively in our modern age of sciences and technology;

(iv) develop and project Nigerian culture, art and language as well as the world's cultural heritage;

(v) raise a generation of people who can think for themselves, respect the view and feelings of others, respect the dignity of labour and appreciate

those values specified under our broad national aims, and live as good citizens;

(vi) foster Nigerian Unity with an emphasis on the common ties that unite us in our diversity;

(vii) inspire its students with a desire for achievement and self improvement both at school and in later life (FRN 2013)

To achieve the above stated objectives, the government plans that

(1) Secondary education should be of six-year duration and be given in two stages, 3 year junior secondary school stage and 3 year senior secondary school stage.

(2) Where possible, two types of schools will be under the same roof; in any case, the separate junior high school complements the senior high school even when it is located in a different place.

(3) Concerning the rate of transition from primary to secondary school, the Third National Development Plan recommended 70 percent which would include admission to craft schools and vocational centre as well as into Junior secondary schools. The target to be aimed at by all states should be 100 percent enrolment (FRN 2013).

The junior secondary education is pre-vocational and academic in naturethe FRN (2013) expressed hope that junior secondary education will be free as soon as possible and will teach all the basic subjects, which will enable

pupils to acquire further knowledge and develop skills. The curriculum is structured as follows:

Core subject	Pre-vocational subjects	Non-Vocational Electives
Mathematics	Basic Technology	Arabic studies
Nigeria Language	Home-economics	French
	Business Studies	Religious and Moral
	Practical Agriculture	Instruction
	Arts and Music	Physical Education

Source: National Policy on Education (FRN, 2013)

Students who leave school at the junior high school stage may then go on to an apprenticeship system or some other scheme for out-of-school vocational training (FRN, 2013).

Teaching and Instructional Learning Methods

Teaching is the most effective and desirable process or imparting knowledge (Abodunrin&Oluokun, 2006). It is conscious as well as intentional set of activities aimed at bringing about learning. Teaching and learning can be seen as a term used to explain the teacher and learner activities. It is the combination of activities directed towards an outcome. Although, teaching is an activitycentred on the teacher, while learning is learners'centred. Teaching is the teacher behaviour or activities designed and performed to guide learners through a variety of selected experiences geared towards the attainment of all round development of the individual, it is also an act of inculcating ideas,

knowledge, principles, attitudes and experienced qualified person to students (learners) with little or no experience in that particular field of study. No wonder Lawal (2013), posited that teaching is a science as well as an art.

On the other hand, learning, simply means modification of behaviour as a function of practice. It accounts for differences in behaviours which are not due to such factors as maturation, sensory adaptation and other phenomenon which may produce observable changes in the activities of the organism. Learning is an ongoing process of thinking, acting, doing and responding to different situations (Lawal, 2013). This implies that it is a basic process in human behaviour at a particular time and place and it is from cradle to grave.

Instructionaltechniques are much smaller in scope than methods. There are special techniques useful in affecting small areas of student behaviour. They are specific, direct and designed to produce a definite behaviour in students. Techniquescould be interwoven with methods and several techniques fit comfortably into a single method. Oduolowu (2002) observed that there are varieties of instructional methods andoutlined them as follows:

1. Cooperative Learning
2. Mastery learning
3. Behavioural modification
4. Precision teaching
5. Engineered environment
6. Advanced organization

7. Individual instruction
8. Questioning
9. Great expectation
10. Value clarification
11. Classroom meeting

History and Types of Cooperative Learning

Johnson and Johnson (2000) and Slavin(2011) have extensively published and reviewedthe literature on cooperative learning. They identified a variety of outcomes of cooperative learning.Achievement increases for all ability levels (high, medium, low); higher-level thinking processes can result; a deeper levelof understanding is possible; critical thinking is promoted;more positive peer relationships result; students exhibit bettersocial skills and provide more social support for their peers;and a higher level of self-esteem can result (Ukadike, 2006).

Ukadike and Iyamu(2007) defined the basic elements of cooperativelearning as: positive interdependence, face-to-face promotiveinteraction, individual accountability, interpersonal and small groupskills and group processing. Individual accountability is the key toinsuring that all group members are in fact strengthened in learningcooperatively. It stems from highly structured, cooperative learningactivities which ensure that every student participates equitably andmeets the learning objectives. Ukadike

and Iyamu(2007) pointed out thatthe following learning outcomes could be probably promoted by cooperativelearning:

- Increased retention.
- More frequent higher-level reasoning, deeper-level understanding and critical thinking.
- Greater achievement motivation and intrinsic motivation to learn.
- Greater ability to view situations from other perspectives
- More positive, accepting and supportive relationships with peers regardless of ethnic, sex, class or handicap differences.
- Greater social support
- More positive attitudes toward profession
- More positive attitudes toward subject areas, learning and college
- Greater psychological health, adjustment and well-being
- More positive self-esteem based on basic self-acceptance
- Greater social competencies.

In their study, Ukadike and Iyamu (2007) integrated cooperative learning with competitive and individualistic learning by providing guidelines for managing critical issues, assessing competencies and involvement, and resolving conflict. They clearly defined each type of learning, pointed out the advantages and disadvantages of each. Their book is helpful for pre-service and in-service teachers who are interested in cooperative learning methods. Likewise, Muraya and Kimamo (2011) pointed out the use of cooperative

learning to promote a culturally plural society within school. They discuss the following topics: the nature of each type of interdependence and the values implicit in each, the types of cooperative learning, the basic elements for effective cooperation, research on the use of cooperative learning and its positive influence on diversity, and the implications of research on cooperation for diversity. Muraya and Kimamo (2011) indicated that:

Cooperative learning promotes greater efforts to achieve, more positive relationships, and greater psychological health than do competitive and individualistic learning. These outcomes indicate that when cooperative learning is used the majority of the school day, diversity among students can be a potential source of creativity and productivity.

Slavin (2011) also pointed out the use of active learning methods through cooperation in the classroom. They showed how college faculty could facilitate students in actively creating their knowledge rather than passively listening to the profession. Their monograph is about “structuring learning situations cooperatively at the college level so that students work together to achieve shared goals”. The concept of cooperative learning was also introduced by Slavin (2011), who offered a practical, down-to-earth approach to cooperative learning and provides practice methods for groups.

Johnson, Johnson and Stanne (2006) developed a method called Students Teams-Achievement Divisions (STAD) which involves competition among groups. In this method, students are grouped heterogeneously by ability,

gender,race and ethnicity. They learn materials in teams and take quizzes as individuals. Individual scores contribute to a group score. Slavin, (2011)considered this method appropriate for teaching a variety of subjects.

In a cooperative learning classroom, students were placed in small groups and they work together under the teacher's guidance to attain group goals that could not be obtained by working alone or competitively. In such a classroom environment, students discuss, help each other learn and encourage personal achievements among other members in the group. Thus, the way in which lessons are organized can influence students' interactions with others, knowledge, and attitudes (Mtsem 2011). Cooperative learning has the advantage of using this method in different subjects and levels, starting from elementary school to university.However, this kind of pedagogical approach requires very experienced and well-trained teachers who know how and when to assign learning objectives to students and how to monitor each learner within each small group.

Furthermore, the cooperative learning approach makes subjects more interesting and promotes effective learning. Also, it improves intergroup relations, self esteem, attitude toward class and the advantage of working in a team (Johnson & Johnson 2000; Slavin 2011). As the result of some studies, university students demonstrate greater academic achievement over a long term through the use of cooperative learning than through other traditional teaching methods.

Effect of Cooperative Learning Method on AcademicAchievement

Hundreds of research studies of team-based learning in higher education have been conducted, with most of them yielding positive results for a variety of cognitive and affective outcomes. Analyses of the research support the following conclusions:

According to Johnson; Johnson andStanne (2006);

Individual student achievement was superior when cooperative methods were used as compared with competitive or individualistic methods. The achievement outcomes measured include knowledge acquisition, retention, accuracy, creativity in problem solving, and higher-level reasoning. Other studies show that cooperative learning is superior for promoting meta-cognitive thought, persistence in working toward a goal, transfer of learning from one setting to another, time on task, and intrinsic motivation For example, students who score in the 50th percentile when learning competitively would scored in the 69th percentile when taught cooperatively.

Similar positive effects of group interactions have been found specifically for chemistry courses. In a meta-analysis of research on cooperative learning in high school and college chemistry courses, Bowen (2000) found that students in the 50th percentile with traditional instruction would be in the 64th percentile in a cooperative learning environment.

In the research conducted by Hake (2005) several studies of active/collaborative instruction report positive effects on a variety of cognitive

and affective outcomes. In a compilation of pre-post test gains in force concept inventory scores obtained by students in introductory physics courses, the use of instruction involving "interactive engagement" led to an average gain two standard deviations greater than was observed for traditionally-taught courses. In the observation of Terenzin, Cabrera, Colback, Parante and Bjorklund (2001) Students in engineering capstone design courses taught with active and collaborative approaches outperformed traditionally-taught students in acquisition of design skills, communication skills, and teamwork skills. The use of collaborative methods had significant positive effects in understanding science and technology, analytical skills, and appreciation for diversity, among other outcomes (Cabrera; Crissman, Bernal, Nora, Terenzini&Pascarella 2004).

In the research conducted by Spinger, Stanne and Donovan in (2005), the affective outcomes were also improved by the use of cooperative learning. Relative to students involved in individual or competitive learning environments, cooperatively taught students exhibited better social skills and higher self-esteem, as well as more positive attitudes about their educational experiences, the subject area, and the college (Johnson; Johnson &Stanne (2006). Towns, Kreke and Fields (2000) used field notes and survey data to analyze students' attitudes toward group activities in a physical chemistry class. The students viewed the group work as a positive force in their learning, and they also valued the interactions for promoting a sense of community in the classroom.

Implementation and Benefit of Cooperative Learning Method

Hinde and Kovac (2001) discussed two courses that introduced team-based learning in different ways. In the second semester of a physical chemistry course for chemistry and chemical engineering majors, biweekly computer-based group work sessions supplemented traditional lectures, and in the second semester of a biophysical chemistry course taken primarily by biochemistry majors, an approach based on group work with occasional supplementary mini-lectures was used. The group sessions in both courses were inquiry-based. The self-selected teams of three or four in the biophysical chemistry course were given guidelines on effective teamwork, and both peer ratings and self-ratings of student achievement on teams contributed to the final course grades. In the physical chemistry course there was little difference in achievement between the classes in question than the previous classes that had been taught without group work, but this result is not surprising in view of the fact that the group activities were infrequent and most of the defining criteria for cooperative learning were not met. In the biophysical chemistry course the instructor's assessment was that the students gained considerable conceptual understanding and problem-solving ability as well as critical thinking and teamwork skills, but no comparison with a control group was carried out that would elevate the assessment of the course beyond the anecdotal level. The author concluded that the course would have been improved by providing more structures and feedback, maintaining a better balance between individual and group work, and

doing more to promote individual accountability (e.g, give more individual tests) and positive interdependence (e.g. establish and rotate assigned roles within teams). Hinde and Kovac's study is related to the present study in the sense that both studies are on cooperative learning. However, the study differs from the present study in the sense that while Hinde and Kovac's study was on chemistry, the present study dealt on basic technology.

A better example of cooperative learning implementation and assessment is provided by Tien, Roth and Rampmeter (2002), who conducted peer-led team learning in a first-semester organic chemistry course over a three-year period and compared the achievement of the students with that of students who had taken a traditional version of the course in the preceding three years. The course instructor, text, examination structure, and grading system were the same for both the treatment and comparison groups. While instruction in teamwork skills is not necessarily a component of Peer-Led Team Learning (PLTL) in this case the peer leaders were trained in group dynamics and group skills and used their training to help the student teams learn to function effectively. It is therefore fair to say that the PLTL implementation described in this study fully qualifies as cooperative learning. On average, the workshop students significantly outscored their traditionally-taught counterparts on individual course exams, final course grades, retention in the course, and percentage earning the minimum acceptable grade of C- for moving on to the second semester organic chemistry course. Similar results were obtained specifically

for female students and underrepresented minority students. The treatment group found the workshops and workshop problems their most important aids to learning in the course. Similar findings have been reported for Peer-Led Team Learning (PLTL) programs in an organic chemistry class at another institution by Wamser (2006) and in a biology course by Ajaja and Eravwoke (2010), as well as for a cooperative learning implementation in organic chemistry as observed by Dania (2014).

A classical implementation of cooperative learning in chemistry is that of Hanson and Wolfskill (2000) who used a "process workshop" format in the general chemistry class at SUNY-Stony Brook. Students worked in teams of three or four on activities that involved guided discovery, critical thinking questions that help provide the guidance, solving context-rich and sometimes open-ended and incompletely defined problems, and meta-cognitive reflecting. Most activities focused on a single concept or issue and could be completed in a 55-minutes session. Following each workshop, students completed an individual quiz on the workshop content, thus promoting individual accountability. The use of this approach led to substantially improved examination grades relative to the previous year, in which the course was conventionally taught, as well as increased attendance at recitation and tutorial sessions and improvements in student self confidence, interest in chemistry, andattitudes toward instruction. The same authors report on an interactive computer-assisted learning model that supports and enhances the process

workshop format by providing immediate feedback on student efforts networked reporting capabilities, and software tools for both peer assessment and self-assessment. Wolfskill and Hanson, (2001).

Academic Benefits

Concentrating on academic achievement at the academic level provides the unique opportunity to examine the effects of cooperative learning on a group of students who are largely self-motivated and self-directed learners. These students have learned to work and succeed in variety of instructional setting throughout their schooling careers. Academicachievement using cooperative learning in the college classroom suggest that cooperative learning promotes significant cognitive results even for the most esteemed of student populations. One recent study of nearly 500 undergraduate engineering students from six diverse institutions indicated that cooperative learning produced “statistically significant and substantially greater gains in student learning than those associated with more traditional instructional methods.” Even with differences in pre-coursecharacteristics and learning advantages, levels of understanding and retention still increased in the cooperative learning settings (Terenzini et al 2001). In a lecture-based college class, estimates show that the teacher speaks 28 Journal of Business Administration and Education about 80% of the time. Thus, in a class with 30 students each student has less than 30 seconds to speak every hour (Attle, 2007). Research has shown that students learn by doing, thinking critically about concepts and then applying their knowledge to diverse

situations. In a cooperative learning setting, students mustnot only coherent their understanding to their teammates but also have the luxury of immediate feedback from their peers (Slavin, 2011).

Social-Emotional Benefits

The skills employers most seek in their new employees are "communication skills, interpersonal skills and initiative". Employers most desired were:

- Sociability-demonstratesunderstanding, friendliness, adaptability, empathy.
- Self-Management-assesses self accurately, sets personal goals, monitors progress, and exhibits self-control.
- Ability to participate as member of a team -contributes to group effort.
- Ability to exercise leadership -communicates ideas to justify position, persuadesand convinces others, responsibly challenges existing procedures and policies.
- Ability to work with diversity-works well with men and women from diverse backgrounds.

Knowing content academic is not enough to make today's college graduate competitive in the workplace, they must be taught and have the opportunity to practice the social and personal competencies necessary to survive in the work place. Compared to other forms to instruction cooperative learning helps students become better communicators and listeners, cooperative

members of a team areeffective leaders (Yusuf, andAfolabi, 2010).Using cooperative learning the college setting helps breakthe stereotype that students working together are “cheating.” Instead, it enables students with the mindset that one must exercise their collaborative skills and work with others to achieve a 29 Journal of Business Administration and Education Common goal. In addition to promoting social skills, cooperative learning also enhances personal competencies of self-reflection and accurate self-assessment. By working closely with others students, learners can evaluate their own strengths and weaknesses, utilizing the diversity of the group to accomplish their mutual goal. By considering how well the group worked together, the effectiveness of social skills used as well as the creation of goals for further growth, cooperative learning encourages students to become reflective practitioners and strive for continuous improvement.

Gender Issues in Technology Education

Modern developments in science and technology have changed our quality of living. Human lives are governed by developments in science and technology more than ever before, form birth through growth and development to death. The trend does not distinguish between male and female as science affects us all. This might be the underlying objectives for science and technology education for all and science 2000+ project. Since the effects of developments in science and technology is irrespective of gender, then Basic Technology education must also be irrespective of gender. Thus there is the

need to teach science and technology to all youngsters from age 5 to 15 (Bichi, 2002).

According to Green (2009) the concept ‘gender, refers to the amount of masculinity or feminity found in an individual. However, there are mixtures of the two traits in human beings. In a normal man there is a preponderance of masculinity and a normal female has preponderance of feminity. Garba (2012) view that at the age of eleven young people demonstrate sex-stereotyped behaviours in favour of male children due to cultural and socio-economic set ups, especially the child rearing practices. Oppong (2013) reiterating the report by Croubach (1969) argued that it is not genetic factors that have created any difference in academic achievement between males and females in science education and occupations.

At the age of 13 and 14 years youngsters attach labels to school subjects (Bichi, 2002). Bichi rated different subjects on a masculine femine scale: English, French, Typing and cookery were rated as mostly highly femine, History and Biology fairly neutral on the scale while woodwork and physics were rated most highly masculine.

According to Oludipe (2012) the domination of females by males in Science Technology and Mathematics (STM) education is traceable to 1863 school enrolment figures. The female enrolment then was put at 20% while 80% was for the males. In 1984, UN made a universal declaration of Human Rights in free and compulsory education. This declaration led to expansion of girls

schools all over the country and later such programmes as UPE increased number of schools enrolment. In addition, the teaching and learning of science started spreading across the country.

In science education there is the concern that there is male domination such that girls enroll less in science education, demonstrate lower academic achievement, have less experiences with instructional materials and instruments and receive inadequate attention and encouragement from teachers.

However, Studies by Esiogbu (2011) revealed no gender related differences in academic achievement between male and female students. Thus, from the literature there are conflicting reports on gender related differences in achievement in school science. The research on gender related differences in school biology concepts is not conclusive and inadequate (STAN,2002). Consequently, researchers are making efforts in order to device among others teaching methods that will be gender friendly and will enhance science teaching and learning

Factors Affecting Students Academic Achievement

The Teaching and Learning processes are faced with various challenging factors which in turn affect the students' achievement. According to Okoye (2006), some of the factors or conditions that influence learning are:

i. Learning Factor: This involves the personality of the learner such as the learner's age, sex, interest, readiness, social relationship, home background, general disposition, and parent educational qualification.

ii. Internal Factor: This is closely linked with the learning factor which is the emphasis on intellectual/mental achievement level or ability and heredity.

iii. External Factor: This has to do with the environment such as rural/urban, in/outside classroom, teachers' perception of his role. However, a poor environment results in low quality learning while anxiety, fear, stress, and anger inhibit learning. Absence of these factors in addition to conducive environment, emotional stability and social drives promote learning.

Other factors include the:

i. Qualification of the teacher
ii. Teachers level of mastery of the subject matter
iii. Availability of resources
iv. Utilization of resources
v. Teachers' teaching methods
vi. Teachers' ability to improvise

Furthermore, a number of studies have been carried out to identity and analyse the numerous factors that affect academic achievement in various centres of learning. Their findings identified students' effort and previous schooling,parents' education and family income (Green, 2009), self motivation, age of students and learning preferences, entry qualifications and class attendance (Garba, 2012), as factors that have a significant effects on the students' academic achievement in various settings.Although there has been considerable debate about the determinants of academic achievement among educators, policymakers, academics, and other stakeholders, it is generally agreed that the impact of these determinants vary (in terms of extent and

direction) with context, for example, culture, institution, and course of study. A good match between students' learning preferences and instructor's teaching style has been demonstrated to have positive effects on student's achievement (Oludipe 2012). Infact, Oppong(2013) reported that some students seem to learn better when information is presented through words (verbal learners), whereas others seem to learn better when it is presented in the form of pictures (visual learners). Clearly in a class where only one instructional method is employed, there is a strong possibility that a number of students will find the learning environment less optimal and this could affect their academic achievement.

Green (2009) established that alignment between students learning preferences and an instructor's teaching style lead to better recall and understanding. Research on this subject seems to provide a consensus that students who miss classes perform poorly compared to those who attend classes. Socioeconomic status of students and their families show moderate to strong relationship with academic achievement (Sirin, 2005). Social economic status is most commonly determined by combining parents' educational level, occupational status and income level (Garba, 2012). In most of the studies done on academic achievement of students, it is not surprising that social economic status is one of the major factors studied while predicting academic achievement. It is believed that low social economic status negatively affects academic achievement because low social economic status prevents access to vital resources and creates additional stress at home (Jabeen and Khan, 2013)

Considine and Zappala (2002) carried out a study on social economic status in education research and policy found that social economic background remains one of the major sources of educational inequality and adds that one's educational success depends very strongly on the social economic status of one's parents. Green (2009) agree with (Considine and Zappala2002)), in their study on the influence of social and economic disadvantage in the academic achievement of school students in Australia found that families where the parents are advantaged socially, educationally and economically foster a higher level of achievement in their children. They also found that these parents provide higher levels of psychological support for their children through environments that encourage the development of skills necessary for success at school.

On the contrary Ohland (2006) in the study conducted on educational and social economic background of undergraduates and academic achievement at a Brazilian university, found that students coming from disadvantaged socioeconomic and educational homes perform relatively better than those coming from higher socioeconomic and educational strata, this is called phenomenal educational resilience. This could be true considering that different countries have different parameters of categorizing what a developed country categorizes as low social economic status of a developing country; Family income, according to Green (2009), has a profound influence on the educational opportunities available to adolescents and on their chances educational success.

Green adds that due to residential stratification and segregation, low-income students usually attend schools with lower funding levels, have reduced achievement motivation and much higher risk of educational failure. When compared with their more affluent counterparts, low-income adolescents receive lower grades, earn lower scores on standardized test and are much more likely to drop out of school.

Considine and Zappala (2002) reported that children from families with low income are more likely to exhibit the following patterns in terms of educational outcomes; have lower levels of literacy, innumeracy and comprehension, lower retention rates, exhibit higher levels of problematic school behaviour, are more likely to have difficulties with their studies and display negative attitudes to school. Similarly, Green (2009) in a study exploring beliefs about academic achievement studied the relationship between parent and guardian educational attainment to academic achievement and concluded that the educational attainment of parent or guardian does have a relationship with academic achievement of their children, the researcher argued that the higher the parent or guardian's educational achievement, the higher the academic achievement.

From the aforementioned, it can be seen that social economic status is related to academic achievement, whether one studies social economic status as a whole or with distinct dimensions, there is considerable support to hypothesize that parents' social economic status affects academic achievement

of students. (Garba2012). Students who come from low social economic backgrounds earn lower examination scores compared to their counter parts from high social economic backgrounds. According to Oppong (2013) the type of school a child attends influences educational outcomes. Considine and Zappala (2002) citing Sparkles whose study in Britain shows that schools have an independent effects on student attainment and that school effects is likely to operate through variation in quality and attitudes, so teachers in disadvantaged schools often hold low expectations of their students which compound the low expectations the students have, hence leading to poor achievement by the students.

Spinath (2012) agreed that school has an effect on the academic achievement of students but argued that school facilities determine the quality of the school, which in turn influences the achievements, and attainment of its pupils. Salami (2013) argues that schools influence learning in the way content is organized and in the teaching, learning and assessment procedures. All these scholars agreed to the principle that schools do affect academic achievement of students which is one of the variable in the present study.

Knowledge RetentionLearning Pyramid

According to this Learning Pyramid, retention rates increased (Felder & Brent 2007) with the amount of student involvement. The rates were the highest with teamwork which included (a) discussion groups: 50%, (b) practice by

doing: 75%, and (c) teaching others/immediate use of learning: 90%. As a sharp contrast, the retention rate of the traditional ways of individual and passive learning like lecturing (5%), reading (10%), and demonstration (30%) lasted no more than 30 percent. In contrast, the retention rate of the long existing method of lecturing was as low as only five percent.

With such low retention rate under five percent, the long existing method of lecturing was indeed in need of more effective teaching methods that involved higher student participation like cooperative learning. From the illustration of the learning pyramid, we could see that the implementation of cooperative learning was not just an alternative to the teacher-centered lecturing method but also cooperative learning will enhance student achievement and success

Related Empirical Studies

Some studies that are related to the current study are discussed in the following paragraphs.

Hussain, Abbas, Nawaz and Javed (2014) conducted a study to see the effects of cooperative learning on the academic achievement and academic self-concept of the students at the elementary school level. The study also investigated these effects across the gender. In this particular study all the 5th class students comprise the population of the study. The sample of the study consists of 40-students of class 5th selected randomly and equated on the basis of pre-test from Nayab English medium School Dera Ismail Khan. Two instruments were used for data collection. One was self-made academic

achievement test which was made valid and reliable through experts view. This test was to determine the academic achievement after experiments. The second instrument was modified version of the Self-description Questionnaire prepared by Marsh in 1992, which was used to check the academic self-concept of the students. The result shows that the cooperative learning method was better than the lecture method in the development of academic achievement and academic self- concepts of the students. Across the gender the self-concept of female was significantly better than the male while there was no difference on academic achievement across the gender.Hussain,Abbas,Nawaz and Javed's study is related to the present study in the sense that both studies are on effects of cooperative learning on academic achievement. However their study was on English and was conducted in Ismail Khan, the present dealt on basic technology and was conducted in Oyo state, Nigeria.

Emaikwu (2012) in a study conducted to assess the relative effectiveness of three teaching methods in the measurement of students' achievement in mathematics had the design of the study as a quasi-experimental pretest posttest research design using intact classes. The studywas carried out in Ogbadibo local government Area of Benue state. The population of the study comprised of five hundred and ninety students in senior secondary school three (SS3), studying mathematics in the mixed secondary schools in the study area and a sample of one hundred and fifty SS3 students were selected from three secondary schools using purposive sampling technique. Intact classes in three schools were used

having a total of eighty five male and sixty five female students. The instrument for data collection was a multiple choice test consisting of thirty item cognitive achievement test in mathematics (CATM) developed by the researcher and with its item selected from trigonometry. The reliability coefficient of the instrument for the study was determined by using Cronbach alpha coefficient to be 0.95.

Furthermore, two research questions were answered and two hypotheses were tested. Mean and standard deviation were used to answer the research questions while the hypotheses formulated were tested using t-tests of statistics and analysis of variance (ANOVA) at 0.05 level of significance and the results indicated that students taught using activity method performed better than those taught using discussion and lecture methods which indicated that there was no significant difference in mean achievement between boys and girls when they were taught using activity method. Also, a significant difference existed in mean achievement scores of male and female students when they were taught mathematics using lecture method. The researcher concluded that there was a significance difference in the mean achievement scores of students taught mathematics using the three pedagogical methods. Hence students' achievementsin Mathematics vary significantly when lecture, discussion and activity methods were used in teaching in favour of activity method. This study is related to the present study because it is an empirical study and also it was conducted to assess the effects of instructionalmethods. However, the study did not asses the interaction effects of treatment and gender on students'

academicachievement, when taught with the three teaching methods and the statistical analysis for testing the two hypotheses because it can only indicate that significant difference existed but could not show the level of effectiveness. Moreover,Emaiku's study was on mathematics conducted in senior secondary schools in Benue state, while the present study was on basic technology conducted in junior secondary schools in Oyo state.

Edu, Ayang and Idiaka (2012) conducted a study on the evaluation of instructional methods and aptitude effects on the psychomotor achievement in basic electricity among technical students in southern educational zone, Cross River state, Nigeria. The study was an experimental, pre-test,post-test control group design and two- research questions were formulated while data was generated from 80 randomly sampled vocational year two students using four researcher-made instruments, lesson plans, basic electricity psychomotor test (BEPT) and a fundamental electricity aptitude test (FEAT). Data was analysed with independent t-test and classification analyses of variance (ANOVA).

The researchers further reported that there was no significant difference of joint effects of demonstration and project instructional methods and aptitude on psychomotor achievement of student in basic electricity. Similarly, the result showed that there was no significant mean difference in the psychomotor achievement of students with high and low aptitude in basic electricity in technical colleges when taught with demonstration and project instructional

methods. It was concluded that the methods coupled with aptitude of students' do not significantly influence the psychomotor achievement of students in basic electricity among vocational year two students in the southern educational zone of Cross River state, Nigeria.

Also the researchers recommended that government should motivate technical school teachers through the provision of ultramodern equipment in all practical workshops and laboratories to enhance effective experimentation and demonstration of technical concepts with students which will enable students to be conversant with practical activities before they graduate out of school. The study is related to the present study because it is on the evaluation of instructional methods in technical college students' psychomotor achievement. However, the study did not assess interactioneffects of treatments and gender on students' academic achievement. Also, Edu, Ayang and Idiaka concentrated their study on technical students in Cross- River state while the present study concentrated on junior secondary school students in Oyo state.

Tumba and Andeyarka (2014) carried out a study to determine the effects of cooperative learning on academic achievement of technical college students in Cross River State in Nigeria. Two research questions and one hypothesis guided the study. The population of the study was 84 technical college students who were grouped into experimental and control groups. The non–equivalent control group, pretest-posttest quasi-experimental design was adopted for the study. Four topics from the 2007 National Board for Technical Education

(NBTE) approved curriculum were used for the treatment. The Pretest and posttest instruments were face and content validated and then trial tested. Reliability indices of 0.86 and 0.76 were obtained for pretest and posttest respectively. The two instruments were used for data collection. The research questions were answered using mean and standard deviation while the hypothesis was tested using z–test. The study found that cooperative learning enhances academic achievement of radio, television and electronics students, hence recommended implementation of cooperative learning in technical colleges.The study is related to the present study because both are on cooperative learning method and on technology, yielded desire result. However, Tumba and Andeyarka's study was on basic electricity in technical colleges in Cross River state of Nigeria, while the present study dealt on basic technology in junior secondary schools in Oyo state.

Chianson, Kurumeh and Obida,(2010),investigated the effects of cooperative learning method compared with the conventionallearning method in order to find out the retention level of students in circle geometry. The studywas carried out on senior secondary II students in the three education zones (Zone A, Zone Band Zone C) in Benue State, Nigeria. The ability of students to grasp and memorize amathematical concept or topic that was taught has become a basic problem in secondaryschools. These problems may arise due to inappropriate teaching methods being used to explainthese topics. Hence, this study adopted the cooperative learning method to teach 358 seniorsecondary two (SSII) students circle geometry, and see how well the learning method may effectively improve on students' ability to retain concepts in mathematics in comparison to theconventional learning method of teaching. An independent t-test analysis was used todetermine whether a statistical significant difference existed between the cooperative learningapproach and the conventional learning approach in terms of students' retention of the taught concept.The findings of the study confirmed that students who weresubjected to the cooperative learning method were able to retain the concepts of circle geometrymore than those students who were taught using the conventional learning approach. Hence therecommendations were that, students would be able to retain and learnt concepts inmathematics for a longer period of time if mathematics teachers applied the cooperative learning method in teaching. The study is related to the present study because both is on cooperative learningmethod and academic

achievement and retention. However,Chianson, Kurumeh and Obida's study was on mathematics in senior secondary schools in Benue state, Nigeria. The present study was on basic technology in junior secondary schools in Oyo State.

Arisoy and Tarim, (2013) carried out the study to investigate the effects of Student Teams-Achievement Divisions (STAD) and Teams-Games-Tournaments (TGT) techniques of cooperative learning on students' academic achievement, retention and social skill levels in mathematics lesson. The study which was applied on 152 students in an elementary school in Adana, Pekanbaru, Indonesia in 2009-2010 academic year was a semi-experimental study and lasted in eighteen weeks. There are two experiment groups and a control group in the study. There are fifty two students in the STAD group. There are forty- eight students in the TGT group. There are fifty two students in the control group. "Mathematics Achievement Test" and "Social Skills Scale" were applied in all groups (STAD, TGT and control groups) as pretest at the beginning of the study and as posttest at the end of the study. After five weeks from the posttest, "Mathematics Achievement Test" was applied again as retention test. At the end of the study, "Interview Form" was used in experiment groups for getting students' opinions about techniques.

Conclusively, TGT was more effective in terms of academic achievement and regarding to retention test, STAD was more effective. There was statistically significant difference in favour of STAD and TGT groups in terms of the social skill levels.The study is related to the present study because it is on

evaluation of teaching methods, academic achievement and retention. However, the study was on mathematics while the present study dealt in basic technology. Also, there was no interaction effect of treatments and gender on students' academic achievement.

Zakaria,Solfitri,Daud andAbidin (2013) carried out a study to determine the effects of cooperative learning on students' mathematics achievement in secondary school students in Pekanbaru, Indonesia. In addition, this study also determined students' perception concerning cooperative learning. The samples of this study consisted of 61 Form Three students. In order to control the differences of dependent variables, a pre-test was given before treatment. After treatment, a post-test was administered to both groups. Two types of instruments were used to collect the data: the mathematics achievement test and open-ended questions on cooperative learning. The pre-test and the post-test data were analyzed using t-test. Content analysis was used for the open-ended questions on cooperative learning. The results showed that there was a significant difference in mean in students' mathematics achievement between the cooperative group and the traditional group. Content analysis data revealed that students in the cooperative group were able to increase their under-standing and to develop their self-confidence. Zakaria, Solfitri, Daud and Abidin's study is similar to the present study in that both studies focused on cooperative learning method and academic achievement but differs because,Zakaria, Solfitri,

Daud and Abidin's study was in mathematics and conducted in Pekanbaru, Indonesia and present study dealt in basic technology in Oyo State, Nigeria.

Isiaka, Moses and Charles (2013), conducted a study to investigate the effects of cooperative, competitive and individualistic instructional methods on the achievement of high, medium and low academic achievers using video instructional package in Niger State. A total of 120 senior secondary school mathematics students were randomly assigned into cooperative, competitive, individualized, and conventional teaching methods. Students from each group were stratified into high, medium and low achievers. Video Instructional Package (VIP) on mathematics and Geometry Achievement Test (GAT) were used as treatment and test instruments, respectively. Analysis of Variance and Scheffe test were used for data analysis. Findings indicated that there was significant difference in the achievement of the groups in favour of cooperative learning method. Students' achievement levels had significant influence on their achievement in competitive and individualized instructional settings. It was recommended that mathematics teachers should employ cooperative learning methods to improve students' achievement to bridge the gap among high, medium and low achiever.Isiaka, Moses and Charles's study is similar to the present study in that both study focused on instructional methodology and high, medium and low achiever.But differs because,Isiaka, Moses and Charles's study was on mathematics while the present study dealt in basic technology in Oyo State.

Ogbuanya (2010) conducted a research to investigate the effects of multiple Intelligence-Based Instructional Approach on students cognitive Achievement in Technical College Electronics Technology. This study was aimed at determining the effects of multiple intelligent-based instructional approaches on technical College students' cognitive achievement. The population for the study comprised all the 308 year two students in four technical Colleges. In all the schools, two classes were randomly assigned experimental and control group. The Instruments used for data collection were conventional lesson plan (lecture), multiple intelligence (MI) lesson plan, Electronics Achievement Test (EAT) and MI inventory. Mean, standard deviation and t-test were used for data analysis. It was found that students taught with MI approach scored higher than those taught with lecture method, MI approach holds a lot of promises for better achievement if properly adopted.Ogbuanya'sstudy is related the present study in the sense that the two studies are on teaching methods and in technology. However, while Ogbuanya's study was on the effects of multiple Intelligence-Based Instructional Approach on students cognitive Achievement in Technical College Electronics Technology, the present study ascertained the effects of cooperative learning method on academic achievement and retention of students in basic technology in Oyo State.

Studies on Gender and Students Academic Achievement

Salami (2013), conducted a study to investigate the effects of gender on academic ethics and academic achievement in selectedfinal year students in the Faculty of Management Sciences at Delta State University, Asaba. A total of123 respondents were randomly selected out of which 100 were found useable. An analysis ofvariance (ANOVA) indicated that gender affect both academic ethics and academic achievement at asignificant value of 0.026 and 0.002 respectively. Attributes of academic ethics are critical to goodacademic achievement. One recommendation is for male students to be assisted in seeking a balancebetween imbibing good academic ethics and other non-academic interests in order to achieve moreacademically. Salami's study is different from the present study in the sense that while Salami's study was on effects of gender in the university in Delta state,the present study was on effects of instructional methodology in junior secondary schools in Oyo state. Both studies are similar in the sense that, they researched on students academic achievement, gender and experimental in nature.

In the research conducted by Okonna, Ushie and Okworo (2014), to study the effects of utilization of Web-based resources and the academic achievement of maritime trainees in Nigeria. The work investigated the effects of gender on the academic achievement of maritime trainees in Nigeria, where Web-Based Resources are used for instruction. Pretest posttest non-equivalent control group design was employed using a total of forty maritime trainees, twenty participants each in the experimental and control groups, from the maritime

industry in Nigeria. Findings showed that no significant difference exists between the academic achievement of male and female maritime security trainees. Both studies are similar they are experimental, researched on the students' academic achievement. However,Okonna, Ushie and Okoro's studydiffer from the present study in the sense that it was conducted on maritime trainees in Nigeria,while the present study was on basic technology students in Oyo state,Nigeria. Also, Okonna, Ushie and Okoro's study is on effects of gender, while the present study was on effects of cooperative learning method

In the research conducted byDania (2014), to investigatesthe effects of gender on student's academic achievement in secondary school Social Studies. The researcher adopted a quasi-experimental design (2x2 non-randomized pre-test, post-test control group)comprising six groups made up of four experimental groups and two control groups. Six schools and onehundred and eighty (180) Upper basic 2 students in Delta and Edo States made up the sample for the study. Sixintact classes were randomly selected and assigned to experimental and control groups. The instrument used inthis study is the achievement instrument tagged "Social Studies Achievement Test" (SSAT). The validity andreliability of these instruments were established. The reliability of the instruments was established using Pearsonproduct moment correlation coefficient (r). And the reliability coefficients obtained was 0.79. Means, StandardDeviation, Analysis of covariance (ANCOVA) Result revealed that:

gender (male/female) had no significant effects on students' achievement in Social Studies and finally, results showed that there was significant interaction effect of treatment and gender on students' academic achievement in Social Studies. Dania's study is similar to the present study in that effects of treatment and gender on students' academic achievement are focused, However Dania concentrated on social studies of upper basic two students in Edo state, while the present study dealt in basic technology of junior secondary school two in Oyo state.

Akuezuilo and Chinweoke (2009) conducted a study on "Effectiveness of Prior Knowledge of Behavioural Objectives and Study Questions on female Students' Mathematics Achievement". The researcher used a quasi experimental research design for the study. A Mathematics Achievement Test (MAT) instruments were administered to 1,600 SS II and data collected were analyzed using mean, ANOVA and Scheffe-test. The result showed that female students achieved slightly better than their male counterparts.

Both studies are similar in that female students performed slightly better than their male counterparts. The studies differ in the schools and population used

Eze, Ezenwafor and Molokwu (2015) studied the effect of meta-learning teaching method on the academic performance of building trade students in technical colleges in South-east Nigeria. Two research questions guided the study and two hypotheses were tested at 0.05 level of significance. A quasi-

experimental design involving experimental and control groups plus pre-test and post-test was adopted. Population of the study was all the 376 National Technical Certificate (NTC) year II building trades students. A sample of 120 was purposively drawn for the study. Instrument for data collection was Building Trades Performance Test (BTPT) validated by experts with a reliability coefficient of 0.60. Data were analyzed with mean, standard deviation and ANCOVA. It was found that Metal-learning Teaching Method (MTM) improved students' academic performance in building trades. Both studies are similar because they revealed academic performance and based on instructional delivery or method of teaching. The studies differed in the area of studies and population used.

Eze, Ezenwafor and Obidile (2016) conducted a study on effect of gender on students' academic performance and retention in financial accounting in technical colleges. Technical colleges in Anambra state were chosen for the study. Four research questions guided the study and two null hypotheses were tested at 0.05 level of significance. Quasi experimental design of pre-test, post-test non randomized control group was adopted for the study. Population was all the 168 National Business certificate (NBC) year II students from all the 11 state owned technical colleges in the area. A sample of 138 was purposively selected to compose the experimental and control group based on school that offer accounting and have both male and female students. Experimental group were exposed to problem-based teaching method(PBTM) while the control

group were exposed to lecture teaching method. Instrument for data collection was Accounting Achievement Test (AAT) validated by three experts with a reliability coefficient of 0.83 arithmetic mean was used to analyze data relating to research question while analysis of co variance (ANCOVA) was used to test the null hypothesis. Findings revealed that male and female students taught financial accounting using PBTM performed better with higher post test scores than those taught with lecture teaching method. Also the findings revealed that there was no significant difference in the post test mean score and also in the mean retention scores of male and female student taught financial accounting using PBTM. Based on the finding, it was concluded that adoption of PBTM in the teaching of financial accounting would enhance the performance of financial subject. Consequently,it was recommended among others that accounting teacher at post basic education level should use PBTM which is more practical and stimulating involving all students to enhance students' academic performance and retention in the subject.Eze, Ezenwafor and Obidile's study is related to the present study in the sense that both studies are on effects and knowledge retention. However their study was on effects of gender on students' academic performance and retention in Financial Accounting in Anambra State while the present study dealt on effects of cooperative learning method on academic achievement and retention of students' in Basic Technology in Oyo State.

Summary of Review of Related Literature

Conceptual framework dealt with concept of cooperative learning method, academic achievement and retention. The theoretical framework covered social learning theories. The theoretical studies covered teaching and instructional learning method, causesof poor academic performance of students. Review of related empirical studies covered studies on effects of different teaching and learning methods on students' academic achievement and retention. The review also showed that different methods of teaching and learning can be usedin teachingBasic Technology. Among all these methods, those that allow students' active participation (student- centered) have been advocated as capable of improving academic achievement of students in Basic Technology more than those methods that are teacher- centered. Empirical studies were reviewed on effects of different teaching methods on students' on academic achievement and retention.

Most of these studies ascertained the effects of teaching method on students' academic achievement and did not include retention. Most of the studies were conducted in different subject areas, levels of education and locations. In all the literature reviewed, no work on the effect of cooperative learning method (CLM) on achievement and retention of students' in Basic Technology wasseen to have been carried out in junior secondary schools in

Oyo State with reference to Basic Technology. These gaps prompted the researcher to carry out this study.

CHAPTER THREE

METHOD

This chapter describes the method that was used in the study, it is organized under; research design, area of the study, population of the study, sample and sampling technique, instrument for data collection, validation of the instrument, reliability of the instrument, experimental procedure, methodof data collection and methodof data analysis.

Research Design

The study adoptedquasi-experimental design, where pre-test and post-test wereinvolved. Quasi-experiment is a process where random assignment of subjects to experimental and control is not possible(Uzoagulu, 2011). In this case, intact or pre- existing groups were used.It is not always possible to use true experimental design in conducting educational research. This is due to the fact that the school authorities may not allow the control or manipulation of some relevant variables which they may consider as disruption of school activities. Under such a situation the researcher will resort to quasi-experimental designs using intact groups for the research.

Non-Equivalent Pretest Post-test Control Group Design

Group	**Pre-test**	**Treatment**	**Post-test**	**Delayed post-test (Retention)**
GP_1	0_1	E_1	0_2	0_3
GP_2	0_1	C_2	0_2	0_3

Symbolically the design is presented below:

Where:

O_1 represents pre-test observation for the two groups

O_2 represents post-test observation for the two groups

O_3 Represents delayed post-test observation for retention for the two groups

E_1 represents experimental group

C_2 represents control group

GP_1 represents experimental groups

GP_2 represents control groups

Area of the Study

The study was carried out in Oyo state in the south west Nigeria. Oyo state is bounded in the west by republic of Benin and part of Ogun state, in the east by Osun state, in the north by Kwara state and in the south by Ogun state. (See Appendix O, page 178) Oyo state has 33 local government areas with the capital at Ibadan. It occupies a total land space of about 280,454sqkm and has a

population size of about 5,591589 people. It contains six educational zones. The state is widely known for her achievement in commercial activities, civil services and traditional occupation like farming. This is seen with the numerous industries, private and public establishment operating in the area. The people living in the state have passion for education. This is seen by the number of educational institutions springing up in the area, both private and public. The rationale for choosing Oyo State as the area of the study was informed by the persistent poor academic achievement in Basic Technology among junior secondary students between 2011 and 2015 as shown in Appendix P on page 181.

Population of the Study

The population of the study consists of 19,892 (9,842 males and 10,050 females) JSS 2 students in 602 public secondary schools inOyo Statein 2016/2017 academic year.The JSS2 classes was chosen for the study because they are the main stream students as JSS 1 are new and JSS 3 are candidates ready to write external or public examination such as National Examination Council (NECO) and Basic Education Certificate Examination (BECE). The sample distribution by Senatorial district and gender is presented in Appendix B on page 110.

Sample and Sampling Technique

The sample of the study was 114 (44 males and 70 females) JSS 2 students,Purposive sampling technique was used based on schools that offerBasic Technology and with have a good number of students, teachers and other relevant materials.Two schools that met the above criteria were drawn using simple random sampling technique. Simple random sampling technique (balloting with replacement)was also adopted in assigning the twoschoolsto experimental group (E) and control group (C). Experimental group is the group that was taught with the cooperative learning method while control group is the one that received no treatment and was taught with conventional method. Experimental groupconsisted of 58 students (20 males and 38 females) whilecontrol group consisted of 56 students (24 males and 32 females). Thesample distribution is presented inAppendixB on page 110.

For the purpose of this study, the high achieving student were determined by selecting student with 75 percent and above in the class assessment test scores while the low achieving student were those with 25 percent and below as recommended by Jabeen and Kahn (2013) . This information was obtained from the school records of continuous assessment of the sampled schools.

Instrument for Data Collection

The instrument used for this study was Basic Technology Achievement Test (BTAT). Theachievement test consists of 40 objective test items adaptedfromBasic EducationCertificate Examination (BECE) andBasic

Technology past questions ofNational Examination Council (NECO), between 2010 and 2015. Each item has four alternative answers and each correct answer has one (1) point while each incorrect answer has zero (0) point. The test items covereddrawing practice, tools and machine,applied electricity and electronics, energy and power, maintenance and building.

Validation of the Instrument

The instrument for data collection was validated by three experts,two experts from the Department of Vocational Education and one expert from Department of Science Education, all in Faculty of Education, Nnamdi Azikiwe University, Awka, AnambraState. The experts were given the topic, purpose of the study, research questions, null hypotheses, content to be covered, the lesson plan and the instrument. They were requested to scrutinize the test items for clarity, ambiguity in language, repetition ideas and content coverage. Their input were used to reduced number of the test items from 50 t0 40 which was approved by the researcher supervisor. The validators' inputare enclosed as Appendix S, on page 189.

Reliability of the Instrument

The reliability of the instrument was determined withthe test-retest method whereby it was administered to 30 JSS 2 students at Comprehensive Grammar school, Osogbo in Osun State which were not part of the population of the study. The 40 item instrument was administered for 60 minutes and re-administered after the interval of two weeks as recommended byUzoagulu,

(2011). Pearson Product Moment Correlation was used to determine the degree of linear relationship between the two sets of scores andthe reliability coefficient of 0.82 was obtained. This value was considered evident of reliability in line with Abonyi (2011) who posited that any figure above 0.50 is an acceptable reliability value.

Method of Data Collection

The Basic Technology Achievement Test (BTAT) was administered as pre-test to the respondents in both experimental groups and control groups. Post-test was administered after the treatment, the same instrument was reshuffled and the colour of the paper changed before administering it, as delay post-test. Each test lasted for a period of 60 minutes and was scored in the answer sheet provided. One question carried 1 mark to make a total of 40 marks.See AppendixE, F,G,H,I,&J on pages 147-167.

Experimental Procedure

The researcher visited the schools and obtained permission from the Principalto involve the Basic Technology students and their teachers in the study. The experiment wasin two phases as follows;

Phaseone:Exclusive briefingof the participating teachers as the research assistants who taught the control group with conventional method and the treatment group with cooperative learning method. This visitation was done two weeks before the commencement of the treatment. The

researcheragreedwith the two teachers used on the appropriate time in order not to disrupt the normal activitiesof the school.

In the first contact: The researcher explained the purpose of the study to the research assistants (Basic Technology Teachers) and introduced the concept of cooperative learning method and conventional teaching method. Cooperative learning method was used.It was assumed that all the participatingteachers are familiar with the conventional teaching method, where the teachers explained almost every concept to students.The researcher gave out the prepared lesson plans to both conventional methodteachersand cooperative learning methodteachers (see Appendix C, page 112) on the five topics selected for the teachers to take home and study.

In the second contact: The researcher discussed the lesson plans and gave explanations and clarifications, emphasizing that the topics in the lesson plans should be used. Student's cooperation was sought throughout the instruction and text books on Basic Technology listed below was used as reference point: Basic Technology co-authored by Bamiro ;Nurudeen, and Akuru(2014). The topics in Basic Technology content comprises, you and technology, safety, materials and processing, drawing practice, tools and machine,applied electricity and electronics, energy and power, maintenance and building which was taught for four weeks.

In the third contact: Model teaching on the use of cooperative learning method and conventional teaching methodwas done by the researcher and the

participating teachers andoral evaluationfollowedthereafter to ensured that the briefed teachers have acquired the methods involved in the cooperative learning method and conventional teaching method.

Phase two: Administration of instrument

Three different types of tests were administered duringstudents' treatment. They were pre-test post-test and delayed post-test (retention) The lesson started with a pretest to measure the level of students' knowledge based on the selected topics (see Appendix E, page 147) The BTAT items wereadministered to both control and experimental group. The teaching of the selected topics followed.The control groupwas taught with conventional method and the experimental group with cooperative learning method for four weeks, The prepared lesson plan was used in each case(see Appendix C & D, on page 112 and 130 respectively). The same BTAT was given to both experimental and control group as post-test and later, as delayed post-test (retention). The researcher supervised the administration of the three tests with the assistance of the participated teachers to ensure cooperation and similarity of supervision and class control.

Control of Extraneous Variables

The following measures were employed to control some of the extraneous variables in this study.

1. **Initial group difference**: Randomization is one of the procedures used to control initial group difference in non-experimental studies. However, this was not done in this study since the process would disrupt normal

school administration. In place of that, intact classes wereused. To control the initial differences of subjects in these intact classes, Analysis of covariance (ANCOVA) was employed in data analysis.

2. **Experimental Bias**: When researcher involves external teachers as a research assistant (subjects) in their experiment, the students become sensitized that they are being used for a study. Based on that, they tend to behave mechanically and fake most of their actions. This could introduce experimental bias in the study. In order to avoid such bias in the study the regular Basic Technology teachers in each of the school under study werebriefed and used. The researcher monitored whatthe teachers did occasionally to ensurestrict and effective adherence to the instructions.

3. **Teacher variable**: The problem of teacher variable could arise since the different teachers among others possess different levels in terms of knowledge of the content and methodology. As a measure to control this variable in the present study, the researcher prepared the lesson plans (Appendix C and D, page 112-130) on Basic Technology topics which was used to teach both the control groupand experimental groups. The teachers were guided to ensure strict compliance with the lesson plans. The researcher emphasized the use of materials provided for the teaching. The lesson plans provided was used. (The teachers wereguided and educated properly on how to implement cooperative learning method). The guide used is as contained in Appendix C, page 112.

4. **Variability of instructional situation**: Homogeneity of instruction across group was ensured as follows:

   (i) The researcher briefed every teacher on the instructional procedure involved.

   (ii) The teachers involvedwere directed to strictly follow the detailed lesson plans provided.

   (iii) The Cooperative Learning Method (CLM) and Conventional Teaching Method (CTM) groups were taught the same topics and within the regular school period allotted to Basic Technology in the JSS 2 class time-table.

5. **Effects of Pre-test, Post-test and Delayed post test:** In a way the pre-test and post-testwereadministered after four weeks interval. This wasrelatively matched the experimental duration. The pre-test BTAT items were reshuffled and renumbered and colour of paper changed before being used as the delayed post test (retention).

Novelty Effects

To reduce or minimize novelty effects which results due to non-familiarity of the researcher to the students, the researcher visited the experimental group several times before the onset of the experiment. The class teachers were very useful in creating the necessary rapport. The novelty effect did not exist in this situation since the subject teachers were used as research assistant for the groups.

Method of Data Analysis

The data of test scores of the pre-test and post-test and delayed post-test of the groups were collected and analysed. The descriptive statistics of meanand standard deviationwere used to answer the research questions while inferential statistics of analysis of covariance (ANCOVA) was used to test the hypotheses at an alpha level of 0.05.

In the test of hypothesis using ANCOVA, F ratio value was used to determine the acceptance or rejection of the hypothesis. Null hypothesis was rejected where F ratio value is less than the level of significance (0.05) but where F-ratio value is equal to or greater than 0.05, null hypotheses was accepted.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

This chapter presents analysis of data according to the research questions and hypotheses.

ResearchQuestion 1: What is the effect of cooperative learning method (CLM) on academic achievement of students taught basic technology when compared with those taught with conventional teaching method (CTM) using their pre-test and post-test scores?

Data collected in respect of this research question were analysed and presented in Table 1.

Table 1
Mean Achievement Scores of Students Taught Basic Technology Using Cooperative Learning Method and Conventional Teaching Method

Groups	N	Pre-Test	Post-Test	Mean Difference
			$\overline{X}_2$	$\overline{X}_D$
Control Group	56	27.46	33.95	22.84
Experimental Group	58	32.25	56.79	

Table 1 shows control and experimental groups post-test mean achievement scores of 33.95 and 56.79 respectively with a mean difference of 22.84. The result shows that after treatment, the students in the experimental group achieved higher than those in the control group. This indicated that cooperative learning method has positive effect.

Research Question 2: What is the effect on the academic retention means scores of students taught basic technology usingcooperative learning method and those taught usingconventional teaching method using their post-test and delayed post-test mean scores?

Data collected in respect of this research question were analysed and presented in Table 2.

Table 2
Mean retention scores of students in Basic Technology taught using cooperative learning method and those taught using conventional method.

Methods	N	Post-test	Delayed Post-test $\overline{X}$	Mean Difference $\overline{X}_D$
Control Group	56	33.95	32.68	32.80
Experimental Group	58	56.79	65.48	

Table 2: shows control and experimental groups'delayed post-test mean achievement scores of 32.68 and 65.48 respectively with a mean difference of 32.80. The result shows that the students in the experimental group had higher mean retention scores than those in the control group.

Research Question 3: What is the effect of (CLM) on academic achievement of high and low achievers taught basic technology using their pre-test and pro-test scores?

Data collected in respect of this research question were analysed and presented in Table 3.

Table 3
Effect of Cooperative Learning Method on High and Low achievers in Basic Technology.

Groups	Pre-test		Post-test		Mean Difference
	N	Mean $\overline{X}$	N	Mean $\overline{X}$	$\overline{X}$
Experimental:					
High Achievers	13	45.23	25	59.69	14.46
Low Achievers	45	26.67	36	31.67	5.00
Control:					
High Achievers	7	44.71	9	43.11	-1.60
Low Achievers	49	30.08	47	32.19	-1.91

Table 3: shows the pre-test post-testmean academic scores of high and low achievers taught Basic Technology using cooperative learning method (CLM). The focus of research question 3 is on high and low achievers taught Basic Technology using cooperative learning method. The results in Table 3 shows that high achievers taught Basic Technology using CLM obtained a mean score of 45.23 in pre-test and 59.69 in post-test with a mean difference of 14.46 while low achievers taught in the same way obtained a mean score of26.67 and31.67 in pre-test and post-test respectively with a mean difference of 5.00 The result revealed that both highand low achievers were affected positively when taught Basic Technology using cooperative learning method.

Research Question 4: What is the effectiveness of (CLM) on the retention of male and female students in basic technology using their post-test and delayed post-test means scores?

Data collected in respect of this research question were analysed and presented in Table 4.

Table 4
Effect of Cooperative Learning Method on Male and Female Students' in Basic Technology.

Group	Post-test		Delayed Post-test	Mean Difference
	N	Mean	Mean	
	X	$\bar{X}$	XD	$\bar{X}$
Experimental				
Male	30	58.07	66.90	8.93
Female	28	55.43	63.96	8.53
Control				
Male	24	35.21	33.50	-1.71
Female	32	33.00	32.06	-0.94

Tables 4 shows the difference between the mean retention scores of male and female students taught Basic Technology using conventional teaching method (CTM) and those taught using cooperative learning method (CLM). The focus of research question 4 was on male and female students taught using CLM. The data revealed that male students taught Basic Technology using

CLM obtained a mean score of 58.07 in post test and 66.90 in delayed post test with a mean difference of 8.93 while female students taught in the same way obtained a mean score of 55.43 in post test and 63.96 in delayed post test with the mean difference of 8.53. The result presented in Table 4 also indicated that male students differed slightly from their female counterpart in the mean difference by 0.40 in favour of the male students.

Research Question 5: What are the interaction effects of teaching methods and gender on students' academic achievement in Basic Technology?

Data collected in respect of this research question were analysed and presented in Table 5.

Table 5
Interaction Effect of Teaching Methods (CLM and CTM) and Gender on Students' Achievement in Basic Technology.

Group	Pre-test		Post-test	Mean Difference
	N	Mean	Mean	
	X	$\bar{X}$ X	XD	$\bar{X}$
Experimental				
Male	30	32.77	58.07	25.30
Female	28	28.75	55.43	26.68
Control				
Male	24	34.08	35.21	1.13
Female	32	30.28	33.00	2.72

Table 5 indicates that experimental groupspre-test mean scoresfor male (32.77) and female (28.75) were very close as well as the control groups mean scores for male (34.08) and female (30.28). After the treatment, the male students in the experimental group had a higher post-test mean scores of (58.07) than their male counterpartsin the control group (35.21) while female students in the experimental group got a higher post-test mean score (55.43) than their female counterparts in the control group (33.00).There was an increase in the mean achievement scores across both teaching methods and gender. The post-test mean achievement scores of students taught basic technology across the two teaching methods show that male and female benefited from the teaching

methods. This suggests there was no interaction between methods of teaching and gender.

Hypothesis1: There is no significant difference between thepost-test academic achievement mean scores of students taught Basic Technology using cooperative learning method. (CLM) and those taught using conventional teaching method (CTM)

Data utilised to test Ho_1 are presented in Table 6.

Table 6
ANCOVA Summary on Difference in Achievement Scores of Students taught with Conventional Method (CTM) and those Taught with Cooperative Learning Method (CLM).

Source	Type III sum of squares	Df	Mean square	F	P-value	Decision
Corrected model	14871.582	1mj	14871.582	132.778	.000	
Intercept	1389.473	1		12.406	.000	S
Group	14871.582	1	1389.473	132.778	.000	
Error	12544.357	112	14871.582			
Total	264153.000	114	112.003			
Corrected Total	27415.939	113				

Table 6 shows that at 0.05 level of significance and 1 df, the p value is 0.000 which is lower than the level of significance 0.05. This means that there was significant difference between the post-test academicachievementmean scores of students taught basic technology using conventional teaching method and those taught using cooperative learning method. The null hypothesis was therefore rejected.

Hypothesis 2: There is no significant difference between the academic retention mean scores of students taught Basic Technology using cooperative learning method and those taught usingconventional teaching method.

Data utilised to test Ho_2 are presented in Table 7.

Table 7
ANCOVA Summary on Difference in Retention Scores of Students taught with Conventional Teaching Methods (CTM) and those taught with Cooperative Learning Method (CLM).

Source	Type III Sum of squares	df	Mean Square	F	P-value	Decision
Corrected Model	4065.173[a]	1	4065.173	11.998	.001	
Intercept	52437.667	1	52437.667	154.768	.000	S
Groups	4065.173	1	4065.173	11.998	.001	
Error	37949.353	112	338.816			
Total	319858.000	114				
Corrected Total	42012.526	113				

Data in Table 7 show that at 0.05 level of significanceand 1 df, the p-value is 0.001 which is also lower than the level of significance 0.05. This means that there was significant difference in the retention mean scores of students taught basic technology using conventional teaching method and those taught using cooperative learning method. The null hypothesis was therefore rejected.

Hypothesis 3: There is no significant difference between the post-test academic achievements mean scores of high and low achieving students' taught Basic Technology using cooperative learning method.

Data utilised to test Ho_3 are presented in Table 8.

Table 8
ANCOVA Summary on Difference Between Pre-test and Post-test Mean Achievement Scores of High and Low Achieving Students' Taught Using Cooperative Learning Method (CLM).

Source	Type III Sum Square	df	Means square	F	P-Value	Decision
Corrected Model	24945.741	1	24945.741	261.042	.000	
Intercept	55.907	1	55.907	.585	.446	S
VAR00002	24945.741	1	24945.741	261.042	.000	
Error	10894.086	114	95.562			
Total	258484.000	116				
Corrected Total	35839.828	115				

Table 8 shows thatat0.05 level of significance the p-value is 0.000 which is also lower than level of significance. This means that there was significant difference in the achievement mean score of high and low achievers in basic technology using cooperative learning method. The null hypothesis was therefore rejected.

Hypothesis 4: There is no significant difference between the academic retention mean scores of male and female students taught Basic Technology using cooperative learning method

Data utilized to test Ho_4 are presented in Table 9.

Table 9
ANCOVA Summary on Difference between the Mean Retention scores of Male and Female Students taught Basic Technology with (CLM).

Source	Type III Sum Square	df	Means square	F	P-Value	Decision
Corrected Model	5676.735	3	1892.245	8.336	.000	
Intercept	381.874	1	381.874	1.682	.197	NS
Gender	1064.584	1	1064.584	4.690	.032	
Group	219.105	2	109.552	.483	.618	
Error	24968.282	110	226.984			
Total	216582.000	114				
Corrected Total	30645.018	113				

From Table 9: It was discovered that 0.05 level of significance and 2df the P-value is 0.618 which is higher than the level of significance 0.05. This shows that there is no significant difference in the academic achievement retention meanscores of male and female students taught Basic Technology using cooperative learning method. The null hypothesis was therefore not rejected.

Hypothesis 5: There is no significant interaction effect of the teaching methods and gender on students' academic achievement in Basic Technology.

Data utilised to test Ho_5 are presented in Table 10.

Table 10
ANCOVA Summary on Interaction Effects of Teaching Methods and gender on Students Academic Achievement in Basic Technology.

Source	Type III Sum Square	df	Means square	F	P-Value	Decision
Corrected Model	15037.955	2	7518.978	67.427	.000	
Intercept	1473.437	1	1437.437	13.213	.000NS	
Treatment	14477.487	1	14477.487	129.827	.000	
Groups *Gender	166.373	1	166.373	1.492	.225	
Error	12377.983	111	111.513			
Total	264153.000	114				
Corrected Total	27415.939	113				

Table 10 show that at 0.05 level of significance and 1df, the p-value is 0.225 which is higher than the alpha level 0.05. This means that there was no significant interactioneffect of treatments and gender on students' academic achievement in Basic Technology. The null hypothesis was therefore not accepted.

Summary of Findings.

Findings from the analyses presented in this chapter, are summarized as follows:

1. Students taught Basic Technology using cooperative learning method achieved significantly higher in their post test scoresthan those taught with conventional teaching method
2. Students taught Basic Technology using cooperative learning method had higher retention mean scores than those taught using conventional teaching method.
3. Both high and low performing students were positively affected by the use of cooperative learning method but the low performing students were favoured slightly more.
4. Retention mean score of male and female students taught Basic Technology using cooperative teaching method was higher than those taught using conventional teaching method.
5. The interaction effect of teaching methods and gender was insignificant on students' academic achievement in Basic Technology.

CHAPTER FIVE

DISCUSSION OF RESULTS, CONCLUSION AND RECOMMENDATIONS

This chapter focuses on discussion of results of the study, conclusion, implicationsof the study, recommendations and suggestions for further research.

Discussion of Results

Results of this study are discussed as follows:

Effect of teaching methods on students'academic achievement in Basic Technology

The study revealed that students who were taughtBasic Technology using cooperative learning method achieved higher post-test scores than those taught using conventional teaching method. This result is in line with the findings of Hussain, Abbas, Nawaz and Javed (2014) and Tumba and Andeyaka (2014) which reported respectively that cooperative learning method had significant effect on post-test achievement scores of students.

Effects of teaching methods on students' academic achievement and knowledge retention

Results of the study revealed that students taught with cooperative learningmethod retained better what they have learnt over a period of time than those taught with conventional teaching method. This means that the teaching method used in teaching the students was significant on students' retention. This finding is in line with Chrianson, Kurumeh and Obida, (2010) who found that, students who were subjected to cooperative learning method were able to retain

the concepts taught than those students who were taught using conventional teaching method. This could be as a result of activities and experiences involved which made the students to develop their own knowledge meaning and retain the concept taught.

Effects of teaching method (CLM) on students of different academic ability levels (high and low achievers).

The result of the findings shows that the achievement of both high and low achievers was enhanced by the use of CLM. The low achieving students had a little higher mean gain in other words, they were favoured more. The reason may be that, the use of cooperative learning method made learning more concrete and acquired for the low achievers, and made them to achieve more, almost as much as high achievers. This finding agrees with Ausubel and Robinson (2002), and Bell (2012) that meaningful learning occurs when students of varying academic abilities interact with each other in the classroom. The interactionwould bring about higher academic achievement and retention.

Effects of teaching methods on male and female students' achievement in Basic Technology

Findings of the study revealed that male and female students taught Basic Technology using cooperative learning method differ significantly in post-test mean scores. This indicated that the CLM was effectives and has the potential of improving students' academic achievement in Basic Technology. This result is in line with the findings ofAzih and Nwosu (2011), and that of Wynn, Moshorder and Larsen (2014) which reported that students taught with

cooperative learning method performed better, and that gender was in significant in the knowledge retention of students' using CLM.

Conclusion

Based on the findings of the study, it was concluded that cooperative learning method is an effective method for improving students academic achievementas well as knowledge retention in Basic Technology.

Implicationsof the Study

The findings of this study have some educational implications.It was found that cooperative learning method increased students' academic achievement and retention in Basic Technology. This implies that if teachers of Basic Technology involve their students actively in the teaching and learning process through the application of cooperative learning method (CLM), they will acquire in-depth knowledge which will help them retain the concepts and knowledge in Basic Technology.

It was also discovered that use of cooperative learning method favoured low achievers. This implies that cooperative learning method, due to its interactive involvement of both high and low achievers will help students with learning difficulties overcome such problems.

The result also indicated that there is no significant effect of teaching methods and gender on students' academic achievement in Basic Technology. Thus, the cooperative learning method favoured both male and female

studentsequally, showing that the method is effective in instructional deliveryin Basic Technology for both male and female students.

Recommendations

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

1. Teachers of Basic Technology should acquire the knowledge and skills for using Cooperative Learning Method through is-service training, conferences, seminars and workshops
2. School administrators should encourage Basic Technology teachers touse cooperative learning method by providing opportunities for in-service training to equip them with competencies needed in it.
3. Curriculum designers should incorporate cooperative learning method in the Basic Technology curriculum and emphasize activities of teachersand students.
4. Education stakeholders and relevant professional associations such as Nigerian Association of Teachers of Technology (NATT), Association of Vocational and Technical Educators of Nigeria (AVTEN) should sponsor further research on the efficacy of cooperative learning method on other technology subject areas such as so as to arrest the declining academic achievement and enrolment pattern of students in technology and vocational education programme.

5. Government, through the Ministry of Education should ensure the provision of adequate instructional materials at secondary education level to facilitate the use of CLM in the teaching of Basic Technology.

Limitation of the Study

There is no specific limitation to this study.

Suggestions for Further Research

Findings of this study have opened up some areas for further research.They are**:**

1. Replication of the present study to cover a wider geographical area, such as entire Nigeria.
2. Similar studies could be carried out in other areas of technology atseniorsecondary school level such as electronics, applied electricity, automobile mechanics, technical drawing, wood work and metal work.

REFERENCES

Abdullahi, O. E. (2013). Interrelationship between personal factor and academic achievement in mathematics of Ebira secondary schools students in Kogi state.*An International Journal of Psychology*, 5(1), 154-155.

Abodunrin, G.O. &Oluokun, O. (2006).Principles and methods of teaching Ibadan.Oyo State College of Education Publication Series.36-37.

Abonyi, O. S. (2011). Instrumentation in Behavioural Research.A Practical Approach, Enugu, TIMEX publisher.

Adler, R. (1999). Five ideas designed to rile everyone who cares about accounting education. *Accounting Education,* 8(3), 241-247.

Agbatogun, A. (2010) Psycho-socio-factors and students performance in educational technology.*ElectronicsJournal of Psychology*.*7(4)* 25-32

Ajaja, P. O. &Eravwoke, U. O. (2010) Effects on Cooperative learning on Junior Secondary School Students achievements in Integrated Science Electronic *Journal of Science Education South Western University*. 14 (1) http://wwwejse.southwesternedu.

Akuezuilo, E. O. &Chinweoke, F. U. (2009) Effectiveness of prior knowledge of behaviourial objectives and study questions on female students' mathematics achievement.*Journal of STM Education* 1(1), 1-7.

Alaba, M. E. K. (2010) Influence of Gender on the achievement of students in visual Art Programme in the College of Education: *Journal of Educational Research and Policies* 5(2) Duncan Science Publication

Amita Rena Hall, M. A. (2006). Families, Children and Communities in a Multicultural and Diverse Society.*Research paper on curricular models, Nova Southeastern University.*

Anang, J. I. (2013). *Some current issue in teaching and literature*. Retrieved From http://among0592.blongsport.com/2013/01/some-current-issues-in-teaching-and.html?m=1

Anderson, J. R. (2006). Cooperative Learning in the Management Classroom http://www.mountainplains.org/articles/2006/pedagogy/case%and%20solutions%20Volume%207.doc

Arisoy B. and Tarun K. (2013).The effects of cooperative learning on student Academic Achievement, retention and social skill levels.*Journal of Education28(3)* 1-14.

Attle, S. (2007).“Cooperative Learning in a Competitive Environment: Classroom Applications” *In International Journal of Teaching and Learning Higher Education.* 19, (1) 77-83.

Ausubel, D. P. & Robinson, F. G. (2002). *School learning: An introduction to educational psychology*. New York: Holt Rhinehart and Winson Inc.

Azih, U &Nwosu, B. O. (2011).*Research Methods in Education:An Introduction* .Philadelhia: J B Lippincott. Co

Bamiro, O. A; Nurudeen, A. &Akuru, I.O. (2014).*Basic Technology for Schools and Colleges.* Lagos, Evans Brothers Publishers

Bassey, S. W.; Joshua, M. T. &Asim, A. E. (2010).Gender difference and Mathematics achievement of rural senior secondary students.56th proceedings of episteme. Cross River State University of Technology, Calabar

Bell, M. J (2012) Academic performance. Retrieved on March 2nd 2015, from http://www.education.ehowcom.

Bonner, S. (1999). Choosing Teaching Methods Based on Learning Objectives: An Integrative Framework. *Issues in Accounting Education*, 14(1), 11-39.

Bowen, C. W. (2000) A Quantitative Literature Review of Cooperative Learning Effects on High School and College Chemistry Achievement.J. Chem (Ed). 77, 116-119.

Bransford. J.; Brown, A. L.; Cocking, R. R.; Eds (2000) How people Learn:Brain, Mind, Experience and School. Washington, D. C. NationalAcademy http://www.nap.edu/books/0309070368/html accessed October 6, 2006.

Brown, H. & Ciuffetelli, D. C. (Eds) (2009) *Foundational Methods: Understanding Teaching and Learning*, p.507. Toronto: Pearson Education.

Cabrera, E. F.; Crissman, J. L. Bernal, E. M.; Nora, A; Terenzin P. T. & Pascarella, E. T. (2004). *Collaborative learning: it’s Impact on College students Development and Diversity*. J. coll. student Development 43, 20-24.

Chinanso, M.M, Kurumeh, M.S. &Obida J.A. (2010). Effects of cooperative learning method on student retention in circle geometry in secondary schools in Benue state, Nigeria. *American journal of scientific and Industrial Research.4(59-62).*

Considine, G. &Zappala, G.(2002). Factors influencing the educational performance of students from disadvantaged backgrounds. In T. Eardley and B. Bradbury, eds, *Competing Vision: Refereed Proceedings of the National Social Policy Conference 2001,* SPRC Report 1/02, Social Policy Research Centre, University of New South Wales, Sydney, 91-107.

Cottel, P.G., & Millis, B.J. (1993).Cooperative structures in the instruction of accounting.*Issues in Accounting Education*, 8(1), 40-60.

Creswell, J. W. (2009). Research Design: *Qualitative, and Mixed Methods Approach*. London: SAGE Publications, Inc.

Dancis, J. (2009). A hybrid, small group guided discovery method of instruction. Retrieved Jun 7th 2010 from http://en.wikipedia.org/wiki/Discoverylearning

Dania, P. O. (2014). Effects of Gender on Students Academic Achievement n Secondary School Social Studies, *Journal of Education and Practice* 5(21).

Denmart, K. L. (2001). Improving academic performance among native American students: A review of research literature. Retrieved from http://www.gov,com/pdf

Dougherty, R. C. (2007).Grade/Study.*Achievement contracts enhanced communication, Cooperative learning and student achievement J. Chem. 74, 722-726.*

Edu.D.O, Ayang.E.E. &Idiaka, 1.(2012). Evaluation of instructional methods and aptitude effects on psychomotor achievement in basic electricity among technical students in southern educational Zone, *contemporary Research, 2(2), 117-123.*

Effandi, Z., Titi, S. Yusoff, D. and Zulkarnain, Z.A (2013).Effects of cooperative learning on secondary school students' mathematics achievement.*Creative Education 4(2) 98-100.*

Emaikwu, S.O. (2012). Assessing the relative effectiveness of three teaching methods in the measurement of students' achievement in mathematics.*Journal of emerging trends in educational Reseach and policy studies, 3(4), 479-486.*

Emmanuel, E. A; Musa, H. W and Zipporah, P. D. (2013) Do all cooperative learning methods have potential.To Eliminate Gender Difference In Students' Achievement in Biology? A Field Report or STAD and JIGSAW methods: *Journal of Science, Technology, Mathematics and Education* 9(4) 184-197.

Eniayeju, A.A. (2010). Effects of cooperative learning strategy on the achievement of primary six boys and girls in mathematics.*ABACUS Journal of Mathematical AsssociationOf Nigeria, 35(1), 1-9.*

Epunam, A.D (2009). *Influence of school environmental variables on academic performance as perceived by student* (Unpublished master's thesis) University of Nigeria, Nsukka.

Esiogbu G. O. (2011) Achieving gender equity in science class: shift from competitive to cooperative learning. *Multicultural Education and Technology. 5 (4), 244-257.*

Etukudo, U.E. (2006). The effects of Computer Assisted Instruction on gender and achievement of junior secondary school in mathematics. ABACUS *Journal of Mathematical Association of Nigeria*, 27 (1), 1-8.

Eze, T. I.(2013).Language and Culture in Technical Vocational Education and Training.*Journal of Nigeria Languages and Culture* 14(2), 1-16.

Eze, T. I., Ezenwafor, J. I. and Molokwu, L. I. (2015) Effect of Meta-learning Method on the Academic Performance of Building Trades Students in Technical Colleges in South-east Nigeria. *International Journal of Vocational and Technical Education*7(10),101-108.

Eze, T.I., Ezenwafor, J. I. &Obidile, J. I.(2016) Effect of Gender on Students' Academic Performance and Retention in Financial Accounting in Technical Colleges.British *Journal of Education, Society &Behavioural Science.*18 (4) 1-9.

Federal Republic of Nigeria, (2013).*National Policy on Education*; Lagos, NERDC Press.

Felder R. M. & Brent Rebecca (2007).Mabrouk P. A. (ed) Active learning:*Models from Analysis Science, ACS Symposium SeriesWashington*, D. C. American ChemicalSociety.Pp. 34-53.

Gagne R. M. and Briggs L. J. (1979).Principles of instructional design. New York, Holt, RichartWitson.

Garba, A. (2012) Secondary Education in Nigeria: *A Synthesis of Basic Student-Specific Concerns from Guidance and Counselling Perspective.* Journal of International Cooperation in Education 15 (2) 195-205.

Gbaje, E. S. (2007).*Managing gender in inclusive class.* A paper presented at ETF capacity Building for Science, Teachers. Plateau State Polytechnic Jos Campus, Jos on June 20th unpublished.

Green, S. B. (2009) Graduation rates in Nigeria's education system. *Journal of Applied Psychology, 2 (4), 66-90.*

Hake, R. R. (2005) Interactive – Engagement Vs Traditional Methods: *A six Thousand – students survey of Mechanics Test Data for Introductory Physics courses*. J. Physics 66, 64-74.

Hall, J.S.B. (2002). Teaching methods and retention. England: *Institute of Applied Behavioural Science, 2(3).*

Hanson, D. & Wolfskill T. (2000) Process Workshops.*A new model for instruction*. J. Chemistry Ed77, 120-130.

Harrison, C. (2008) Education for tomorrow's vocational teachers: *Overview. Digest 67.*

Hinde, R. J.; Kovac J. (2001) *Students active Learning methods in Physical Chemistry. J. Chem 78, 93-99.*

Houghton, M. (2007).The American Heritage *Medical Dictionary*.Mifflin publishing company United Kingdom.

Hussain, L., Abbas, A., Nawaz, Q. &Javed, M. (2014).Effects of cooperative learning on the academic achievement and selfconcept of the students at the elementary school level.*Gomal University Journal of Research,* 30 (2).

Ibrahim Y. (2004). *Introduction to teacher education*. Ilorin Nathadex press ltd pp. 45-50.

Igboko, K.O. &Ibeneme, O.T. (2006).Effects of some cognitive constructivism instructional approaches on student' achievement and retention in the study of introductory technology in Nigeria.*Journal of Science Teachers Association of Nigeria*, 41 (1 & 2), 37-43.

Igwe, A.U. &Ikatule, O.R. (2011).Effect of computer tutorial and drill(CTD) on senior secondary school student's achievement in basic electronics in Lagos State.*Proceeding of Nigerian Association of Teacher of Technology).Umunze, 108-119.*

Iqbal, M. (2004).*Effects of cooperative learning on academic achievement of secondary school students in mathematics.* Unpublished Ph.D. thesis submitted to the University Institute of Education and Research. University of Arid Agriculture, Rawalpindi, Pakistan.

Isiaka, G.; Moses, J. & Charles, O.O. (2013).The African symposium.13(2).*Effects of Video- Based cooperative learning method on high, medium and low academic achiever*.

Jabeen, S. & Khan, M. A. (2013).A study of need achievement of high and low achievers.*Journal of Education and Practice*, 4(4), 225-235.

Jacob, B.A. (2002). Where the boys aren't: *non-cognitive skills, returns to school and the gender gap in higher education.* Economics of Education Review, 21, 589-598.

Johnson, D. W. Johnson, R. T. &Stanne M. E. (2006). Cooperative Learning Methods: A metaanalysis University of Minnesota, Minneapolis: http: *//www.co-operation.org/pages/66methodshtml*(accessed October 5, 2006).

Johnson, D., & Johnson R. (2000).*Learning together and alone cooperative, competitive and individualistic learning.* Needham Heights, MA: Prentice – Hall.

Kara, I. (2008). The Effect on Retention of Effect of Computer Assisted Instruction Education. *Journal of Educational Psychology* 35(4).Retrieved on February 22, 2013 from http://www.freepatentsonline.com/articles:j.

Kelley, M., Darcy, H., &Haigh, N. (1999).Contemporary accounting education and society.Accounting Education: *An International Journal*, 8(4), 321-340.

Kundu, C.L&Tutoo, N.N (2002).*Educational psychology*. Sterling publishers: New delhi.

Lawal, Y.O. (2013). Education as an instrument for effective national development: Which way Nigeria. *Business and Entrepreneurship. Journal 2(2), 27-38.*

Liaquat, H.,Asif, A.,Qayyum, N. and Muhammad.J. (2014).Effects of cooperative learning on the academic achievement and self concept of the students at elementary school level.*Gomal University Journal of Research*, 30(2) December, 2014.

Mckeachie, W. (2007) Teaching Tips: *Methods, Research and Theory of College and University Teachers* (10thed) Houghton Mifflin, Migglin, Boston M.A USA. P.16

Mckeachie, W. J. (2009) Teaching Tips: *Methods, Research and Theory for College and University Teachers* (11thed) Bostom, M. A. Houghton Mifflin.

Moore, K. D. (2008). *Effective instructional methods: From theory to practice. Thousand Oaks, CA*: Sage Publications.

Mtsem, A. A. (2011*). Effects of diagnostic and contextual instructional method on students' interest and achievement in secondary school Algebra.*A Ph.D thesis of the faculty of education, Benue State University, Makurdi.

Muraya, D. N. &Kimamo, G. (2011).Effects of Cooperative learning approach on biology mean achievement scores of secondary school students in Macharas District, Kenya, *Science Education 69(4) 205-212.*

National Examination Council (2014).*Annual National Report.Minna.National Examination Council.*

National Science Teachers Association NSTA (2003) Gender Equity in Science Education.A Position Statement.Available at http:www.nsta.org.

National Teachers Institute (2009) Basic Science and technology: *Manual for the re-training of primary school teachers.*A millennium development goals project. Kaduna National Teacher Institute.

Nigerian Educational Research and Development Council (2007) *9 – Year Basic Education Curriculum:* Basic Technology for Junior Secondary 1-3, NERDC, Abuja.

Oakley, B.; Felder, R. M.; Brent, R.; &Elhajj, I (2004) Turning student. Groups into Effective Teams, *Journal of student centered learning* 2 (1), 9-34. http.//www.ncsu.edu/felderpublic/paper/Dokley paper(JSCL).pdf/accessed)October6,2006.

Oduolowo, E. O. (2002). Education from Ancient Time to Early 20th Century.*Basic Process in Education*. Ibadan Andrian Publication (1-15).

Ogbuanya, T. C. (2010). The Effects of Multiple Intelligence – Based Instructional Approaches on students cognitive. Achievements in Technical College Electronics Technology.*Journal of vocational and Adult Education* 7(1) 1-3.

Ogunniyi, M. B. (2009). Science, Technology and Mathematics.*International Journal of Science Education*, 18 (3), 267 – 284.

Ohland, M. W. Loughy, M. L. Carter, R. L.; Bullard, L. G.; Felder, R. M.Finelli, C. J. Layton, R. A.; Schmucker, D. G. (2006). The Comprehensive Assessment of Team Member Effectiveness(CATME): *A new peer Evaluation Instrument Proceedings of the ASEE Annual Conference, Chicago, IL.*

Okeke, B.C. (2008, September). *Encouraging gender equality in technical and vocational education at the secondary school level*. A paper delivered at the Nigeria Association of Teachers of Technology South East capacity Building Workshop/ Seminar Anambra State.

Okonna, K., Ushie, B. C. &Okworo, G. (2014). Effects of gender on academic achievement of Maritime Trainees in Nigeria taught with Web-Based Resources. *International Journal of Asian Social Science.* 4(3) 379-382.

Okoye, Z. O. (2006). Classroom environment, computers and students' effective performance.An effective profile.*Journal of Experimental Education, 62,* 221-239.

Oldham, G. (2000). *Gender equity in Scienceand Technology. Does it matter?*A keynote Presentation at a conference on Gender, Science and Technology.United Nationals Commission for science and technology Montevideo, Uruguay Available at http://www/gap.wigsat.org/oldham.html.

Oludipe, D. I. (2012). Gender difference in Nigeria. Junior Secondary students academic achievement in Basic science. *Journal of Educational and Social Research*, 2(1) 43-98.

Omotayo, B. K. (2014). Teachers' characteristics and students' performance level in senior secondary school financial accounting.*Journal of Empirical Studies. 1 (2) 48-53.*

Oppong, C.A. (2013). Gender Differences in students' achievement in history at Senior High School in Cape-Coast, Ghana.*Journal of Arts and Humanities* 2 (1).

Owodunni, A. S.; Saka-Alikinla, I. &Fadairo, O. O. (2013) Effects of shifting interaction questioning Technique on students achievement in Basic Electricity in Technical Colleges. *Journal of Science, Technology Mathematic and Education* (JOSTMED) 10(1) 101-115.

Qayyum, N. Liaquat, H. Asif, A. and Muhammad, J. (2014).Effects of cooperative leaning on the academic achievement and self concept of the students' at elementary school level.*Gomal University Journal of research* 30(2)

Ransdem, R. (2009). The relative effects of inquiry and lecture methods on the high and low achiever in senior secondary schools.*Journal of Social Research,* 3(6), 123-131.
(1) Retrieved on 5th June 2012 from http://wwwejse.southwesternedu.

Rosser, S. V. (2012) Group Work in Science, Engineering and Mathematics: *Consequence of Ignoring Gender and Race coll.*Teaching 46(3) 82-88.

Safo, A. D., Ezenwa, V. I. &Wushishi, D. I. (2013). Effects of computer Assisted Instructional Package on Junior secondary Schools' Achievement and Retention in Geometry in Minna Niger State, Nigeria, *International Journal of Humanities and social science invention, 2(5), 69-74*. Retrieved from www.Ijhssi.org.

Salami, C. G. E. (2013).Gender and Academic Achievement in Delta State University.*Universal Journal of Education and General Studies.* 2(3) pp. 118-126.

Salau, M. O. (2002). The effects of class size on achievement of different ability groups in mathematics. *Journal of Science Teachers' Association of Nigeria, 31(1), 27-33.*

Shrun, J &Glinson, E. (2001).*Teacher's handbook contextualized language instruction.* New York: Heinle and Heinle

Slavin, R. E. (2011). Instruction Based on Cooperative Learning. In R.E. Mayer & P.A Alexander (Eds.), *Handbook of Research on Learning and Instruction (pp. 344-360)*. New York: Taylor & Francis.

Spinath, B. (2012). *Academicachievement.* In Encyclopedia of human behaviour (2nd ed.) San Diego, CA: Academic Press.

Stefanelli, R. (2006).*Gender equity*. Is there gender equity in your classroom? Available at http/:www.cedu.niu.edu/shumow/itt/Gender.

Terenzini, P. T. Cabrera, A. F.; Colbeck, C. L.; Parente, J. M. &Bjorklund, S. A. (2001) Collaborative learning versus Lecture or discussion: *students reported learning gain*. J.Eng Education 90, 123-130.

Tien, L. T. Roth, V.; B &Kampmeier, J. A. (2002) Implementation of a peer Led Team LearningApproach in an Undergraduate Organic Chemistry course.*J. Research in Science Teaching 39, 606-632*.

Towns, M. H. Kreke, & Fields.A. (2000). An Action Research Project: students Perspectives onsmall. Group Learning in Chemistry. *J. Chemistry 77, 111-115.*

Tumba, I and Andeyarka, T.N. (2014).Effects of cooperative learning on academic achievement of radio and television servicing trade students in technical college of Taraba state, Nigeria.*International journal of Educational and Research*: 2(6).

Ukadike, J.O. and Iyamu, E.O.S. (2007), Effects of Cooperative Learning Methods and Sex of Students on Social Studies Achievement in Selected Secondary Schools in South Central Nigeria. *Journal of Studies in Education.*3(1).

Ukadike J.O. (2006), "Effects of two Co-operative Instructional Methods on Social Studies Achievements in JSS". *Journal of Arts and Social Sciences.* 2,(3).

Umar I., Abdullahi, Z . & Hassan, H (2015) *Effects of cooperative learning on secondary school students' achievement in financial accounting*. Paper presented at the International Conference on Accounting Studies, Johor Malaysia 5(2) 79-93.

Utulu, R. E. (2007). The Curriculum and the teacher.*Theory and practice*. (Rev.ed) Makurdi: Selfers Publishers.

Uwaemeiye, R. &Osunde, A.U. (2005).Analysis of enrolment pattern in Nigerian Polytechnics' academic programmes and gender imbalance.*Journal of Home Economics Research. 6(1), 150-155.*

Uzoagulu A. E. (2011).*Practical Guide to Writing Research Project Reports in Tertiary Institutions*.Enugu. Cheston Ltd.

Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Havard University Press.

Waganjo, M.M, Ngesa, F, Cheplogoi S &wambugu, P.W. (2014). Effects of cooperative learning approach on secondary School Student Academic Achievement in Agriculture in Nakuru Sub-county, Kenya. *Internatonal journal of Humanities social science and Education* 1(7) pp 191-197

Wamser, C. C. (2006). Peer-Led Team in Organic Chemistry; Effects on student achievement success and Persistence in the course.*J. Chem. Ed 83 1562 1566.*

Wolfskill, T. & Hanson, D. LUCIS (2000).A new model for computer Assisted Learning.*J. Chem. 78, 1417-1424*.

Woolfolk, A (2001). *Educational psychology*. Boston: Allyn and Bacon.

Wynn, C. T., Mosholder, R. S. & Larsen, C. A. (2014).Measuring the Effects of Problem- Based Learning on the Development of Postformal Thinking Skills and Engagement of First- Year Learning Community Students.*Learning Communities Research and Practice, 2(2), Article 4*. Available at: http://washingtoncenter.evergreen.edu/1crpjournal/vol2/iss2/4

Yager, R. E. (2000).*The Constructivist Learning Model*. The Science Teacher, 67(1), 44-45.

Yusuf, M. O. &Afolabi, A. O. (2010). Effects of computer assisted instruction (CAI) on secondary school students' achievement in biology. *The Turkish Online Journal of Educational Technology*. 9 (1) Retrieved on 15th January, 2010 from http://www.tojett.edu.com

Yusuf, M. O. (2007). *Effects of videotape and slide-tape instructions on junior secondary students' achievement in social studies*.Unpublished PhD Thesis, Curriculum Studies and Educational Technology, University of Ilorin, Nigeria.

Zain, Z. M., Subramaniam, G., Rashid, A. A., &Ghani, E. K. (2009).*Teaching Students' Achievement and Attitude Canadian Social Sciences, 5(6), 92-102*

Zakaria, E.,Solfitri, T., Daud, Y. &Abidin, Z. Z. (2013). Effects of Cooperative Learning on Secondary School Students' Mathematics Achievement, *Journal of science research 4(2), 98-100.*

AppendixA

PLAN ON TEACHING BASIC TECHNOLOGY FOR FOUR WEEKS

Period	Duration	Topic
1st Week	80 minutes	Administration of Basic Technology Achievement Test (BTPT) to both experimental and control groups.
2nd Week	80 Minutes	Drawing Practice, Drawing Instrument and materials, paper size, layout, title block tools and machine, meaning and classification.
3rd Week	80 minutes	Concept of electricity, appearance based pm electricity.
4th Week	80 minutes	Energy and power – source of energy, types of energy, maintenance – types and advantages

Appendix B

Sample Distribution

S / N	Name of Junior Secondary School	Senatorial District	Male	Female	Total
1.	St Anne's Grammar School, Ibadan	Ibadan/Ibarapa	20	18	38
2.	Wesly College Ibadan	Ibadan/Ibarapa	22	16	38
3.	Ibadan Grammar School, Ibadan	Ibadan/Ibarapa	24	22	46
4.	Government College Ibadan	Ibadan/Ibarapa	25	23	48
5.	St. Theresa's College Ibadan	Ibadan/Ibarapa	28	18	46
6.	Apata School Ibadan	Ibadan/Ibarapa	27	22	49

7.	Obaolufun High School, Igboora	Ibadan/Ibarapa	22	19	41
8.	N.U.D Grammar School, Eruwa	Ibadan/Ibarapa	20	22	42
9.	Ayete Grammar School, Ayete	Ibadan/Ibarapa	28	18	46
10.	Urban Day Grammar School, Ibadan	Ibadan/Ibarapa	25	25	50
11.	Olivet High School, Oyo	Oyo South Senatorial District	28	20	48
12.	Ojongbodu Grammar School, Oyo	Oyo South Senatorial District	29	18	47
13.	Ogbomoso Grammar School, Ogbomoso	Oyo South Senatorial District	22	23	45
14.	Ansarudeen Grammar School, Ogbomoso	Oyo South Senatorial District	20	27	47
15.	Isale-Oyo Community Grammar School, Oyo	Oyo South Senatorial District	18	24	42
16.	Fiditi Grammar School, Fiditi	Oyo South Senatorial District	22	24	46
17.	Aponmode High School, Akinyele	Oyo South Senatorial District	18	25	43
18.	Iware Community Grammar School, Iware	Oyo South Senatorial District	19	26	45
19.	Awe High School, Awe	Oyo South Senatorial District	20	19	39
20.	Ijawaya Community Grammar School, Ijawaya	Oyo South Senatorial District	18	23	41
21.	Iseyin Grammar School, Iseyin	Oyo North Senatorial District	22	26	48
22.	Anwal-ul- Islam High School, Iseyin	Oyo North Senatorial District	20	38	58
23.	Ekunle High School, Iseyin	Oyo North Senatorial District	18	23	42
24.	Otu Baptist High School, Out	Oyo North Senatorial District	18	18	36
25.	A.D.S. Grammar School, Saki	Oyo North Senatorial District	24	32	56
26.	Ogbooro Community High School, Ogbooro	Oyo North Senatorial District	18	24	42
27.	Okere High School, Saki	Oyo North Senatorial District	22	25	47
28.	Baptist High School, Kisi	Oyo North Senatorial District	17	21	38
29.	A.D.S Grammar School, Igbeti	Oyo North Senatorial District	19	24	43
30.	Community Grammar School, Igboho	Oyo North Senatorial District	18	25	44
	Total		**9,842**	**10,046**	**19,892**

AppendixC

LESSON PLAN FOR TEACHING THE EXPERIMENTAL GROUP USING COOPERATIVE LEARNING METHOD

WEEK ONE

SUBJECT:- Basic Technology

CLASS:- JSS II

TOPIC:- Safety; Materials and Processing.

DURATION:- 2 Periods (40 minutes each)

Specific Objectives: By the end of the lesson, the students should be able to:

(i) define safety

(ii) mention first aid materials

(iii) identify types of materials

(iv) differentiate materials from each other correctly

(v) explain characteristics of each material.

Content Outline:

(i) Safety

(ii) First Aid material

(iii) Uses of materials

(iv) Identification of wood, metals, ceramics

(v) Classification of materials; wood, metals, ceramics.

Instructional Materials: Real object (pieces of wood; metals; ceramics)

Instructional Method: Cooperative Learning Method (CLM)

Entry Behaviour: Students are familiar with safety and the use of materials such as wood, metals, plastics, ceramic and so on in their homes.

Set Induction: The teacher arouses the students' interest by asking them to explain what they understand by safety.

Instructional Procedure:

Content Development	Cooperative Teacher's Activities	Cooperative Students Activities	Instructional Techniques
Introduction	The teacher asks the students to explain what they understand by safety	They answer the question	Set induction
Definition of safety	The teacher leads the stude	The students listen to the teacher and share experiences within group.	Definition, Explanation and Illustration.
First Aid Materials	The teacher explains the fi	The students listen, ask questions (and clarify meaning)	Explanation and Questioning
Uses of materials such as wood, metal and plastics.	The teacher shows different types of items made of different materials to the students, such as chair, rule or scale rule.	The students observe the materials, identify personal feelings about engineering material and ask questions.	Explanation and Identification
Identification of wood from metals	The teacher differentiates v	The students listen and later share goals with a partner.	Identification and Explanation
Classification of materials such as metals, wood and plastic.	The Teacher explains characteristic of each materials such as wood, metals and plastics.	The students listen to the teacher and share goals with the whole group.	Explanation and Classification
Summary	The teacher mentions the highlights of the lesson. Repeating important definitions, mention materials made of wood, plastic and metals.	The students' liste	Mentioning, Highlighting, Definition and Explanation
Evaluation	The teacher evaluates the lesson	The students respond orally and share goal with the whole group	Questioning
Closure	(i) Define safety	Students are allow together according to their small group or cooperative learning group to work on the teaching to	Assignment

	(ii) Mention first Aid materials (iii) Identify the following materials; wood, metal, plastic (iv) Differentiate wood from metals (v) Classify metals, wood and plastic accordingly.		

WEEK TWO

SUJECT: Basic Technology

CLASS:- JSS II

TOPIC:- Drawing Instrument, Drawing Practice

DURATION:- 2 periods (40 minutes each period)

S**pecific Objectives:-** By the end of the lesson students should be able to (i) Mention drawing instrument

(i) Identify drawing instruments correctly

(ii) Construct lines and angles with aid of pair of compass

(iii) Construct triangles and Quadrilaterals.

(iv) Construct Polygons correctly.

Content Outline:

(i) Drawing Instrument (ii) Practice with drawing instrument

(iii) Construction of lines and angles.

(iv) Construction of triangles and Quadrilateral

(v) Construction of Polygons.

Instructional Materials:- Real object (pair of compass, Drawing board, protractor, scale rule).

Instructional Method:- Cooperative Learning Method (CLM)

Entry Behaviour:- Students are familiar with mathematical instruments and their uses.

Set Induction:- Teacher arouses the students interest by asking them to explain how to construct lines and angles.

Instructional Procedure:

Content Development	Cooperative Teacher's Activities	Cooperative Students Activities	Instructional Techniques
Introduction	The teacher asks the students to explain what they understand by drawing instruments	They answer the question	Set induction
Drawing Instruments	The teacher leads the students to mention drawing instruments such as, pair of compass, protractor, scale rules, Tee-square.	The students listen to the teacher and share experiences within group.	Mentioning and Explanation.
Practice with drawing instrument	The teacher takes a lead ar	The students observe, demonstrate with the drawing instruments and share ways of performing.	Demonstration and Explanation
Construction of lines and angles.	The teacher leads and constructs lines and angles before the students.	The students observe and demonstrate the constructions and discusses with aids to progress.	Demonstration and Explanation
Construction of Triangles and Quadrilateral	The teacher leads and constructs triangles and quadrilaterals with drawing instruments.	The students demonstrate and practice with the drawing instrument.	Demonstration and Explanation
Construction of Polygons.	The teacher leads and demonstrate the construction of polygon before the students.	The students observe and display the constructions with drawing instrument.	Demonstration and Explanation
Summary	The teacher goes over the whole lesson and lay emphasis on the important point.	The students observe and share the facts and goal with group.	Constructing, Demonstrating, Highlighting, and Explanation

Evaluation	(i) Mention drawing instrument (ii) Identify the drawing instrument. (iii) Explain the process of constructing lines and angles (iv) Describe the process of constructing triangles and quadrilaterals (v) Explain the step by step of constructing polygons.	The students respond to the questions orally.	Questioning
Closure	(i) Mention 10 drawing instruments. (ii) Draw the drawing instrument mention in question No 2 above (iii) Construct the following angles (i) 90^0, 75^0 105^0, 60, 30, 15^0, $7^1/_2{}^0$	Students are allow to g	Assignment

WEEK THREE

SUBJECT:- Basic Technology

CLASS:- JS II

TOPIC:- Tools and Machine; Energy and Power.

DURATION:- 2 periods (40 minutes each)

Specific Objectives:- By the end of the lesson, the students should be able to: (i) explain Metalwork hand tools

(ii) identify hand cutting tools in metal work

(iii) practice with driving tools.

(iv) define energy and power

(v) state the units of energy and power

(vi) differentiate energy from power.

Course Content:- (i) Metal work hand cutting tools

(ii) Metal work driving tools (iii) Metal work measuring tools (iv) Energy and power

(v) Units of energy and power

(v) Calculations involving energy and power.

Instructional Materials:- Real object, metal work hand cutting tools, metal work driving tools, metal work measuring tools, charts showing energy and power in a display form.

Entry Behaviour:- Students are familiar with kitchen utensils which are related to metal work hand tools.

Set Induction:- The teachers arouses the interest of the students by asking them to explain hand tools.

Instructional Procedure

Content Development	Cooperative Teacher's Activities	Cooperative Students Activities	Instructional Techniques
Introduction	The teacher asks the students to explain what hand tools	They answer the question	Set induction
Explain metalwork hand tools	The teacher commences the lesson by explaining metal work hand tool to the students.	The students listen and share the experience with the group.	Explanation.
Identify hand cutting tools in metal work	The teacher shows the metal work hand cutting tools to the students.	The students observe and share the experience among the group.	Identification and Explanation
Practice with driving tools.	The teacher display the metal work driving tools before the students.	The students observe the instruction and share the experience among the group.	Identification, Demonstration and Explanation

Definition of energy and power	The teacher leads the students to define energy and power.	The students listen to the teacher and share the experiences among the group.	Explanation
State the units of energy and power	The teacher states the units of energy and power before the students.	The students copy the notes as they listen.	Explanation
Differentiate energy from power.	The teacher solves the problems relating to energy and power calculation.	The students practice the calculation exercise and share the experiences among the group.	Calculating and Explanation
Summary	The teacher goes over the lesson briefly.	The students clarify the ideas among group.	Explanation, Highlighting, and Calculating,
Evaluation	(i) Mention metal work hand cutting tools (ii) List the metal work driving tools you know. (iii) Mention metal work measuring tools. (iv) Define energy and power. (v) State the units of energy and power. (vi)Solve the problems rel	The students response to the questions orally.	Questioning
Closure	(i) Mention 10 metal work hand cutting tool (ii) List five (5) driving tools (iii) Mention 5 metal work (iv) Define energy and power (v) State the units of energy and power (vi)Solve the problems rel	The students copy the questions and begin to share the experience among the group.	Assignment

WEEK FOUR

SUBJECT: Basic Technology

CLASS:- JS II

TOPIC: Applied Electricity and Electronics; Maintenance & Administration of Basic Technology Achievement Test BTPT to both experimental and control group.

DURATION:- 2 periods (40 minutes each)

Specific Instructional Objective:- By the end of the lesson students should be able to: (i) explain the conversion of electrical to heat energy.

(ii) mentionappliance based on conversion of electricalenergy to heat energy

(iii) explain the construction of electrical based appliances

(iv) identify appliance based on conversion of electricalenergy to heat energy.

(v) discuss conversion of chemical energy to heat energy

(vi) describe simple maintenance of domestic good

(vii) applyappropriate maintenance

(viii) explain simple maintenance of furniture

(ix) administration of BTPT.

Course Content:-(i) conversion of electrical energy to Heat Energy

(ii) appliance Based on conversion of Electrical Energy to Heat energy.

(iii) Conversion of chemical energy to heat energy.

(iv) Appliances Based on Conversion of chemical energy to heat energy.

(v) Simple maintenance of domestic goods.

(vi) Maintenance of furniture

(vii) Maintenance of kitchen ware.

(viii) Maintenance of plates and dishes.

Instructional Materials:- Real object and charts.

Instructional Procedure:

Content Development	Cooperative Teacher's Activities	Cooperative Students Activities	Instructional Techniques
Introduction	The teacher asks the students to explain what they understand by conversion of electrical energy to heat energy	They answer the question	Set induction
Conversion of electrical energy to heat energy	The teacher leads the stud	The students listen to the teacher and share the opinion among the group.	Questioning, Definition, Explanation and Illustration.
Appliance based on conversion of electrical energy to heat energy	The teacher mentions the appliances based on the conversion of electrical energy to heat energy.	The students listen to the teacher and share the opinions among the group.	Mentioning and Explanation
Conversion of chemical energy to heat energy	The teacher discusses the conversion of chemical energy into electrical energy.	The students listen and share the opinion among the group.	Explanation
Appliances Based on Conversion of chemical energy to heat energy	The teacher mentions the appliance that operate based on the conversion of chemical energy to heat energy.	The students listen to the lesson and share the opinion among the group.	Mentioning and Explanation
Simple maintena	The teacher leads the students and describes the simple maintenance of domestic goods.	The students listen to the lesson and share experience among the group.	Definition and Explanation
Maintenance of furniture	The teacher explains the simple method of maintaining the furniture.	The students listen to t	Explanation
Maintenance of kitchen ware, plates and dishes.	The teacher explains maintenance of domestic goods such as chair, kitchen ware, crockery and so on.	The students listen to the lesson and share the experiences among the group.	Explanation
Summary	The teacher goes over the whole lesson and lay emphasize on the important points.	The students observed	Explanation and Highlighting

Evaluation	The teacher' asks the following questions from the students. (i) Explain the process of converting electrical energy to heat energy, (ii) List appliances that based on conversion of electrical energy to heat energy (iii) Discuss the process of converting chemical energy to heat energy (iv) Mention appliance that operate based on conversion of chemical energy to heat energy.	The students answer the question.	Questioning
Closure	(i) Explain the process of converting electrical energy to heat energy (ii) Mention five electrical (iii)Discuss the conversion (iv) Explain the term maintenance (v) Explain the process simple maintenance required for the following domestic good (i) furniture (ii) crockery (iii) plates and dishes.	The students are allow	Assignment

AppendixD

LESSON PLAN FOR TEACHING THE CONTROL GROUP USING CONVENTIONAL TEACHING METHOD

WEEK ONE

SUBJECT:- Basic Technology

CLASS: JS II

TOPIC: Safety; Materials and Processing

DURATION: 2 periods (40 minutes each)

Special Objectives:- By the end of the lesson, students should be able to

(i) define safety

(ii) Mention first aid material

(iii) identify types of materials

(iv) differentiate materials from each other

(v) explain characteristics of each materials

Content Outline:

(i) Safety

(ii) First Aid Materials

(iii) Uses of Materials

(iv) Identification of wood, metals, ceramics

(v) Classification of Materials; wood, metals, ceramics

Instructional Material:- Charts and illustration.

Instructional Method: Conventional Teaching Method (CTM)

Entry Behaviour: Students are familiar with safety and the use of materials such as wood, metals, plastics and ceramics.

Set Induction: The teacher arouses the students' interest by asking them to explain what they understand by safety.

Instructional Procedure:

Content Development	Teacher's Activities	Students Activities	Instructional Techniques
Introduction	The teacher asks the students to explain what they understand by safety	They answer the question	Set induction
Definition of safety	The teacher leads the stude	The students listen and ask questions.	Definition, Explanation and Illustration.
First Aid Materials	The teacher explains the fi	The students listen and ask questions.	Explanation and Questioning
Uses of materials such as wood, metal and plastics.	The teacher shows different types of items made of different materials to the students, such as chair, rule or scale rule.	The students' listen and ask questions.	Explanation and Identification
Identification of materials.	The teacher differentiates v	The students listen to the teacher and later ask questions.	Identification and Explanation
Classification of materials.	The Teacher explains characteristic of each materials such as wood, metals and plastics.	The students listen to the instructor and later ask question.	Explanation and Classification
Summary	The teacher goes over the lesson again and points out the facts	The students' liste	Mentioning, Highlighting, Definition and Explanation
Evaluation	The teacher evaluates the lesson	The students respond orally to the questions.	Questioning
Closure	(i) Define safety (ii) Mention first Aid materials (iii) Identify the following materials; wood, metal, plastic (iv) Differentiate wood from metals	The students note the assignment given to them.	Assignment

	(v) Classify metals, wood and plastic accordingly.		

WEEK TWO

SUBJECT:- Basic Technology

CLASS:- JS II

TOPIC:- Drawing Instrument; Drawing Practice

DURATION:- 2 periods (40 minutes each).

Specific Objectives:- By the end of the lesson, students should be able to:- (i) Mention drawing instrument (ii) Identify drawing instruments correctly (iii) Construct lines and angles with the aid of compass (iv) Construct triangles and quadrilaterals (v) Construct polygons correctly.

Content Outline:- Drawing instruments

(ii) Practices with drawing instruments.

(iii) Construction of lines and angles

(iv) Construction of triangles and quadrilaterals

(v) Construction of polygons.

Instructional Materials:- Charts showing drawing instruments

Instructional Method:- Conventional Teaching Method (CTM)

Entry Behaviour:- Students are familiar with mathematical instrument and its uses before.

Set Induction:- The teacher arouses the students interest by asking them to explain how to construct lines and angles.

Instructional Procedure

Content Development	Teacher's Activities	Students Activities	Instructional Techniques
Introduction	The teacher asks the students to explain what they understand by drawing instruments	They answer the question	Set induction
Drawing Instruments	The teacher commences the lesson by mentioning drawing instrument to the students such as Tee-square, compass, scale rule.	The students listen attentively and ask question	Mentioning and Explanation.
Practice with drawing instrument	The teacher draw the instruments on the chalkboard.	The students copy the diagram from the chalkboard.	Demonstration and Explanation
Construction of lines and angles.	The teacher demonstrate the construction of lines and angles on thechalkboard.	The students observe and copy.	Demonstration and Explanation
Construction of triangles and quadrilateral	The teacher demonstrates	The students copy as they observe the teacher.	Demonstration and Explanation
Construction of Polygons.	The teacher explain the steps involves in the construction of polygon.	The students' copy as they observe from the chalkboard.	Demonstration and Explanation
Summary	The teacher goes over the lesson briefly.	The students listen attentively.	Constructing, Demonstrating, Highlighting, and Explanation
Evaluation	(i) mentiondrawing instrur (iii)describe the process of (iv) explain the step by step of constructing polygon.	The students answer the questions orally.	Questioning
Closure	(i) Mention 10 drawing instruments. (ii) Draw the drawing instrument mention in question No 2 above (iii) Construct the following angles (i) 90^0, 75^0 105^0, 60, 30, 15^0, $7^1/_2{}^0$	The students copies the work.	Assignment

WEEK THREE

SUBJECT:- Basic Technology

CLASS:- JS II

TOPIC:- Tool and Machine; Energy and power

DURATION:- 2 periods (40 minutes each)

Specific Objectives:- By the end of the lesson, students should be able to:- (i) explain metal work hand tools.

(ii) identify hand cutting tools in metal work

(iii) practice with driving tools (iv) define energy and power (v) state the unit of energy and power. (vi) differentiate energy from power.

Course Content:- Metal work hand cutting tools

(ii) metal work driving tools (iii) metal work measuring tools

(iv) define energy and power (v) units of energy and power.

(vi) calculation involving energy and power.

Set Induction:- The teacher arouses the interest of the students by asking them to explain hand tools.

Instructional Materials:- Charts showing metal cutting tools, metal measuring tools and metal driving tools; displays of energy and power.

Instructional Procedure:

Content Development	Teacher's Activities	Students Activities	Instructional Techniques
Introduction	The teacher asks the students to explain what hand tools	They answer the question	Set induction
Explain metalwork hand tools	The teacher commences the lesson by explaining metal work hand tool to the students.	The students listen and ask questions.	Explanation.
Identify hand cutting tools in metal work	The teacher' shows the charts containing metal work hand tools and draw some on the chalkboard.	The students listen and ask questions.	Identification and Explanation
Practice with driving tools.	The teacher explains metal work driving tools to the students.	The students listen and ask questions.	Identification and Explanation
Definition of energy and power	The teacher leads the students to define energy and power.	The students listen to the teacher and ask question.	Explanation
State the units of energy and power	The teacher states the units of energy and power before the students.	The students listen and ask question.	Explanation
Differentiate energy from power.	The teacher solves the problems relating to energy and power calculation.	The students copy the work and ask questions.	Calculating and Explanation
Summary	The teacher goes over the lesson briefly.	The students copy the note and ask questions.	Explanation, Highlighting, and Calculating,
Evaluation	(i) Mention metal work hand cutting tools (ii) List the metal work driving tools you know. (iii) Mention metal work measuring tools. (iv) Define energy and power. (v) State the units of energy and power. (vi)Solve the problems rel	The students response to the questions orally.	Questioning
Closure	(i) Mention 10 metal work hand cutting tool (ii) List five (5) driving tools	The students copy the assignment and ready to provide solution.	Assignment

	(iii) Mention 5 metal work (iv) Define energy and power (v) State the units of energy and power (vi)Solve the problems rel		

WEEK FOUR

SUBJECT:-Basic Technology

CLASS:- JSS II

TOPIC:-Applied Electricity and Electronics; Maintenance of simple domestic good and Administration of Basic Technology Achievement Test.

DURATION:- 2 Periods (40 minutes each)

Specific Instructional Objective:- By the end of the lesson students should be able to:

(i) explain the conversion process of electrical energy to heat energy

(ii) mention the appliance based on the conversion of electrical energy to heat energy

(iii) discuss the process of converting chemical energy to hear energy.

(iv) mention appliances based on the conversion of chemical energy to heat energy.

(v) explain the process of simple maintenance of domestic good.

(vi) practice the simple maintenance of furniture.

Course Content: (i) Conversion of electrical energy to heat energy.

(ii) appliances based on conversion of electrical energy to heat energy

(iii) conversion of chemical energy to heat energy

(iv) appliances based on conversion of chemical energy to heat energy.

(v) simple maintenance of domestic goods.

(vi) maintenance of furniture

(vii) maintenance of kitchen ware

(viii) maintenance of plates and dishes

Instructional Material:-Charts, and chalkboard illustration.

Instructional Procedure

Content Development	Teacher's Activities	Students Activities	Instructional Techniques
Introduction	The teacher asks the students to explain what they understand by conversion of electrical energy to heat energy	They answer the question	Set induction
Conversion of electrical energy to heat energy	The teacher leads the students to explain the process of conversion of electrical energy to heat energy.	The students listen to the lesson and ask questions	Questioning, Definition, Explanation and Illustration.
Appliance based on conversion of electrical energy to heat energy	The teacher lists some appliances based on the conversion of electrical energy to heat energy.	The students listen to the lesson, ask questions and copy the note	Listing and Explanation
Conversion of chemical energy to heat energy	The teacher discusses the conversion of chemical energy into electrical energy.	The students listen to the lesson, copy the notes and ask questions	Explanation
Appliances Based on Conversion of chemical energy to heat energy	The teacher explains some appliances that operate based on the conversion of chemical energy to heat energy.	The students listen to the lesson, copy the notes and ask questions	Mentioning and Explanation

Simple maintena	The teacher explains the process of making simple maintenance of domestic goods.	The students listen to the teachers' and ask questions.	Definition and Explanation
Maintenance of kitchen ware, plates and dishes.	The teacher leads the students to discuss the process or steps involves in the maintenance of furniture kitchenware, plate and dishes.	The students listen to the lesson, ask questions and copy the note.	Explanation
Summary	The teacher goes over the important facts and points.	The students copy the notes and ask questions	Questioning, Highlighting and Explanation
Evaluation	The teacher' ask the following question (i) Explain the process of converting electrical energy to heat energy, (ii) List appliances that based on conversion of electrical energy to heat energy (iii) Discuss the process of converting chemical energy to heat energy (iv) Mention appliance that operate based on conversion of chemical energy to heat energy.	The students react to the questions orally.	Questioning
Assignment	(i) Discuss the conversion of electrical energy to heat energy (ii)Mention five (5) applia (iii) Discuss the conversion of chemical energy to heat energy. (iv) Mention five (5) appliances that operate based on conversion of chemical energy to electrical energy. (v) Explain the process of simple domestic maintenance (vi) Mention steps involved in the maintenance of furniture, kitchenware and plate and listen.	The students copy the	

AppendixE

Basic Technology Achievement Test Instrument

Section A

Students' Bio Data

Supply answers to the following information in the spaces provided:

(i) Class:

(ii) Admission No:

(iii) Sex:

SectionB

Basic Technology AchievementTest

(Pre-Test) Time Allowed: 1 hour

Instruction: Answer each question by picking the correct answer among the options provided and write it on the answer sheet.

1. Which of the following form of energy is used by all machinery? A. Heat B. Light. C. Mechanical D. Sound. E. Wave.
2. The following are sources of energy EXCEPT
   A. Sand B. Sun. C. Water D. Wave. E. Wind
3. The repair work carried out to avoid total breakdown of an equipment is called -------- maintenance.
   A. Corrective B. Periodic C. Predictive D. Preventive E. Routine
4. The refrigerator works on the principle of
   A. Condensation B. Distillation C. Evaporation D. Filteration
   E. Sublimation.
5. Ohm is the unit of ---------- A. current B. force C. power
   D. resistance E. voltage
6. What is the S. I. unit of energy? A. Amperes B. Columb C. Joules
   D. Volts E. Watts.
7. The electrical consumption in our homes is measured by IBEDC in A. kilo watt B. Mega watt C. Micro watt. D. Mill watt. E. Uni watt.
8. The materials that allow the passage of electrons through them are called
   A. conductor B. charges C. elements D. insulator E. neutrons

9. The hand tool used for cutting thin sheets of metal is called A. bench vice B. cross-cut chisel C. folding bar D. snip E. stake.

10. Materials that break easily into pieces are said to be A. brittle B. conductive C. ductile D. elastic E. fusible.

11. Lines that meet at 90^0 are called -------- lines A. horizontal B. inclined C. paralled D. perpendicular E. vertical.

12. Which of the following is NOT a Technical Drawing equipment? A. caliper B. French curve C. pairs of compass D. protractor E. scale rule.

13. The name of a figure with all sides and interior angles equal is--------- triangle. A. acute angled B. equilateral C. isosceles D. right angled E. scalene.

14. Thin long chain lines are used in technical drawing to indicate A. breakages B. centres C. cutting planes D. limitations E. outlines.

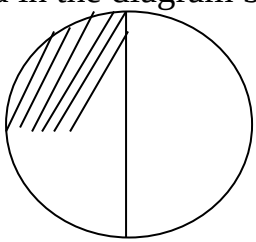
15. A triangle whose two sides are equal is known as A. equilateral B. isosceles C. obtuse-angled D. right-angled E. scalene.

16. Angles are measured in A. centrimeters B. degrees C. grammes D. metres E. millimeters.

17. The tool designed for impelling screws is known as the A. hammer B. mallet. C. pliers D. screwdriver E. Spanner.

18. Electrical insulating materials include the following EXCEPT A. copper B. wood C. mica D. paper E. rubber.

19. The shaded area in the diagram below is called a



A. Chord B. Circumference C. quadrant D. sector E. tangent

20. The flow of electrons in a conductor is known as A. ampere B. coulomb C. current D. power E. voltage

21. When an object is drawn in its given dimensions, it is known as ------- size A. correct B. full C. increased D. real E. reduced.

22. The electric bulb converts electrical energy to A. chemical B. light C. mechanical D. solar E. sound.

23. A bulb rated 100 watt is connected to a supply of 200 volts calculate the amount of current flowing through the bulb. A. 0.50 Amps B. 1.00Amps C. 1.50 Amps D. 2.00 Amps E. 2.50Amps.

24. An electrical instrument that can be used for measuring voltage resistance and current is known as A. ammeter B. multi-meter C. ohmmeter D. voltmeter E. wattmeter.

25. The form of energy released when fuel is burnt in an engine is_____ energy A. electrical B. chemical C. heat D. mechanical E. solar.

26. A pair of divider is used in Technical drawing for A. clipping paper on the drawing board B. constructionsC. drawing lines D. measuring degrees E. transferring measurement.

27. Which of the following safety habits concern all technical workers A. keep long hair B. keeping working environment clean C. lifting heavy load manually D. weaving overall occasionally .

28. An appliance that is used for stepping up or stepping down electrical energy is called ------ A. Transmitter B. Transaction C. Transformer D. Amplifier. E. Translator.

29 The line used for visible edges is known as --------

A. Thin continuous B. Thick continuous line C. Thick dashes line D. Thin continuous wavy line E. Thick long chain line.

30. The immediate primary needs of human beings are ---------A. shelter, Food and cloth B. Education, cloth and Reaction C. Food, shelter and Entertainment D. Recreation, security and cloth E. cloth Entertainment and security.

31. The unit for measuring energy is -------- A. watts B. centimeter C. Density D. Joules E. kilometer.

32. One of the sources of energy is ---------- A. sand B. plastic C. stone D. ceramic E. coal.

33. Example of an appliance that change or converts mechanical energy into electrical energy is --------- A. Generator B. Electric iron C. Grinder D. Refrigerator E. Electric fan.

34. Care for fire and explosion are parts of---------- A. mechanical rule B. chemical rule C. safety precaution rule D. solar rule E. None of the above.

35. The following are drawing instruments except ---------- A. Pencil B. Plum C. French curve D. Tee square E. Scale rule.

36. Metals are classified into -------- categories A. two B. three C. Four D. Five E. Six

37. Food contains -------- energy. A. chemical B. kinetic C.nuclear D. Potential E. Solar.

38. Burning is the process by which -------- energy is converted to -------- energy. A. chemical, heat B. chemical, light C. mechanical, chemical D. mechanical, electrical E. mechanical, heat.

39. The unit of measurement for "power" is called ---------- A. ohm B. volt C. ampere D. watt E. meter

40. Which of the following is a reflex angle?
A. 60^0 B. 90^0 C. 360^0 D. 270^0 E. 45^0

AppendixF

MODEL ANSWERS TO BTAT PRE-TEST

Item No	Correct Option	Item No	Correct Option
1	C	21	B
2	A	22	B
3	D	23	A
4	A	24	B
5	D	25	B
6	C	26	E
7	A	27	A
8	A	28	C
9	D	29	B
10	A	30	A
11	E	31	D
12	A	32	E
13	B	33	A
14	C	34	C
15	B	35	B
16	B	36	A
17	D	37	A
18	A	38	A

1	9	C	3	9	D
2	0	C	4	0	D

Appendix G

Basic Technology Achievement Test (BTAT) Post-Test

Time Allowed: 1 hour

Instruction: Answer each questions by picking the correct answer among the options provided and write it on the answer sheet.

1. Which of the following is a reflex angle?

   A. 60^0 B. 90^0 C. 360^0 D. 270^0 E. 45^0

2. The unit of measurement for "power" is called A. ohm B. volt C. ampere D. watt E. meter

3. Burning is the process by which -------- energy is converted to -------- energy. A. chemical, heat B. chemical, light C. mechanical, chemical D. mechanical, electrical E. mechanical, heat.

4. Food contains -------- energy. A. chemical B. kinetic C.nuclear D. Potential E. Solar.

5. Metals are classified into -------- categories A. two B. three C. Four D. Five E. Six

6. The following are drawing instrumentsexcept A. Pencil B. Plum C. French curve D. The square E. Scale rule.

7. Care for fire and explosion are parts of A. mechanical rule B. chemical rule C. safety precaution rule D. solar rule E. None of the above.

8. A example of an appliance that change or converts mechanical energy into electrical energy is A. Generator B. Electric iron C. Grinder D. Refrigerator E. Electric fan.

9. One of the sources of energy is A. sand B. plastic C. stone D. ceramic E. coal.

10. The unit for measuring energy is A. watts centimeter C. Density D. Joules E. kilometer.

11. The immediate primary needs of human beings are A. shelter, Food and cloth B. Education, cloth and Reaction C. Food, shelter and Entertainment D. Recreation, security and cloth E. cloth Entertainment and security.

12. The line used for visible edges is known as --------

A. Thin continuous B. Thick continuous line C. Thick dashes line D. Thin continuous wavy line E. Thick long chain line.

13. An appliance that is used for stepping up or stepping down electrical energy is called ------ A. Transmitter B. Transaction C. Transformer D. Amplifier. E. Translator.

14. Which of the following safety habits is of concern all technical workers

A. keep long hair B. keeping working environment clean C. lifting heavy load manually D. weaving overall occasionally .

15. A pair of divider is used in Technical drawing for A. clipping paper on the drawing board B. constructions C. drawing lines D. measuring degrees E. transferring measurement.

16. The form of energy released when fuel is burnt in an engine is _____ energy A. electrical B. chemical C. heat D. mechanical E. solar.

17. An electrical instrument that can be used for measuring voltage resistance and current is known as A. ammeter B. multimeter C. ohmmeter D. voltmeter E. wattmeter.

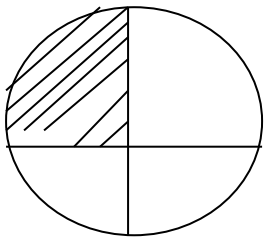
18. A bulb rated 100 watt is connected to a supply of 200 volts calculate the amount of current flowing through the bulb. A. 0.50 Amps B. 1.00Amps C. 1.50 Amps D. 2.00 Amps E. 2.50Amps.

19. The electric bulb converts electrical energy to _____ energy A. chemical B. light C. mechanical D. solar E. sound.

20. When an object is drawn in its given dimensions, it is known as ------- size A. correct B. full C. increased D. real E. reduced.

21. The flow of electrons in a conductor is known as A. ampere B. coulomb C. current D. power E. voltage

22. The shaded area in the diagram below is called a



A. chord B. circumference C. quadrant D. sector E. tangent

23. Electrical insulating materials include the following EXCEPT A. copper B. wood C. mica D. paper E. rubber.

24. The tool designed for impelling screws is known as the A. hammer B. mallet. C. pliers D. screwdriver E. spanner.

25. Angles are measured in A. centimeters B. degrees C. grammesD. metres E. millimeters.

26. A triangle whose two sides are equal is known as A. equilateral B. isosceles C. obtuse-angled D. right-angled E. scalene.

27. This long chain lines are used in Technical Drawing to indicate A. breakages B. centres C. cutting planes D. limitations E. outlines.

28. The name of a figure with all sides and interior angles equal is triangle. A. acute angled B. equilateral C. isosceles D. right angled E. scalene.

29. Which of the following is NOT a Technical Drawing equipment?

A. caliper B. French curve C. pairs of compass D. protractor E. scale rule .

30. Lines that meet at 90^0 are called -------- lines A. horizontal B. inclined C. parallel D. perpendicular E. vertical.

31. Materials that break easily into pieces are said to be A. bristle

B. conductive C. ductile D. elastic E. fusible.

32. The hand tool used for cutting this sheets of metal is called A. bench vice B. cross-cut chisel C. folding bar D. snip E. stake.

33. The materials that allow the passage of elections through them are called

A. conductor B. charges C. elements D. insulator E. neutrons

34. The electrical consumption in our homes is measured by IBEDC in A. kilo watt B. Mega watt C. Micro watt. D. Mill watt. E. Unit watt.

35. What is the S. I. unit of energy? A. Amperes B. Columb C. Joules

D. Volts E. Watts.

36. Ohm is the unit of ---------- A. current B. force C. power

D. resistance E. voltage

37. The refrigerator works on the principle of

A. Condensation B. Distillation C. Evaporation D. Filteration

E. Sublimation.

38. The repair work carried out to avoid total breakdown of an equipment is called -------- maintenance.

A. Corrective B. Periodic C. Predictive D. Preventive E. Routine

39. The following are sources of energy EXCEPT

A. Sand B. Sun. C. Water D. Wave. E. Wind

40. Which of the following form of energy is used by all machinery? A. Heat

B. Light. C. Mechanical D. Sound. E. Wave.

AppendixH

Model Answer to BTAT Post-Test

Item No	Correct Option	Item No	Correct Option
1	A	21	C
2	A	22	C
3	A	23	A
4	A	24	D
5	A	25	B
6	B	26	B
7	C	27	C
8	A	28	B
9	E	09	A
10	C	30	E
11	A	31	A
12	B	32	D
13	C	33	A
14	A	34	A
15	E	35	C
16	B	36	D
17	B	37	A
18	D	38	D

1 9	B	3 9	A
2 0	B	4 0	C

AppendixI

Basic Technology Achievement Test (BTAT) Delayed Post-Test

Time Allowed: 1 hour

Instruction: Answer each question by picking the correct answer among the options provided and write it on the answer sheet.

1. Which of the following is a reflex angle?

   A. 60^0 B. 90^0 C. 360^0 D. 270^0 E. 45^0

2. The unit of measurement for "power" is called A. ohm B. volt C. ampere D. watt E. meter

3. Burning is the process by which -------- energy is converted to -------- energy. A. chemical, heat B. chemical, light C. mechanical, chemical D. mechanical, electrical E. mechanical, heat.

4. Food contains -------- energy. A. chemical B. kinetic C.nuclear D. Potential E. Solar.

5. Metals are classified into -------- categories A. two B. three C. Four D. Five E. Six

6. The following are drawing instrumentsexcept A. Pencil B. Plum C. French curve D. The square E. Scale rule.

7. Care for fire and explosion are parts of A. mechanical rule B. chemical rule C. safety precaution rule D. solar rule E. None of the above.

8. A example of an appliance that change or converts mechanical energy into electrical energy is A. Generator B. Electric iron C. Grinder D. Refrigerator E. Electric fan.

9. One of the sources of energy is A. sand B. plastic C. stone D. ceramic E. coal.

10. The unit for measuring energy is A. watts centimeter C. Density D. Joules E. kilometer.

11. The immediate primary needs of human beings are A. shelter, Food and cloth B. Education, cloth and Reaction C. Food, shelter and Entertainment D. Recreation, security and cloth E. cloth Entertainment and security.

12. The line used for visible edges is known as --------

A. Thin continuous B. Thick continuous line C. Thick dashes line D. Thin continuous wavy line E. Thick long chain line.

13. An appliance that is used for stepping up or stepping down electrical energy is called ------ A. Transmitter B. Transaction C. Transformer D. Amplifier. E. Translator.

14. Which of the following safety habits is of concern all technical workers

A. keep long hair B. keeping working environment clean C. lifting heavy load manually D. weaving overall occasionally .

15. A pair of divider is used in Technical drawing for A. clipping paper on the drawing board B. constructions C. drawing lines D. measuring degrees E. transferring measurement.

16. The form of energy released when fuel is burnt in an engine is _____ energy A. electrical B. chemical C. heat D. mechanical E. solar.

17. An electrical instrument that can be used for measuring voltage resistance and current is known as A. ammeter B. multimeter C. ohmmeter D. voltmeter E. wattmeter.

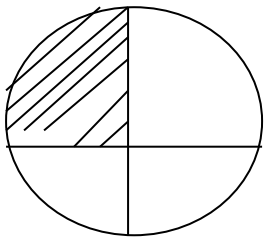
18. A bulb rated 100 watt is connected to a supply of 200 volts calculate the amount of current flowing through the bulb. A. 0.50 Amps B. 1.00Amps C. 1.50 Amps D. 2.00 Amps E. 2.50Amps.

19. The electric bulb converts electrical energy to _____ energy A. chemical B. light C. mechanical D. solar E. sound.

20. When an object is drawn in its given dimensions, it is known as ------- size A. correct B. full C. increased D. real E. reduced.

21. The flow of electrons in a conductor is known as A. ampere B. coulomb C. current D. power E. voltage

22. The shaded area in the diagram below is called a



A. chord B. circumference C. quadrant D. sector E. tangent

23. Electrical insulating materials include the following EXCEPT A. copper B. wood C. mica D. paper E. rubber.

24. The tool designed for impelling screws is known as the A. hammer B. mallet. C. pliers D. screwdriver E. spanner.

25. Angles are measured in A. centimeters B. degrees C. grammes D. metres E. millimeters.

26. A triangle whose two sides are equal is known as A. equilateral B. isosceles C. obtuse-angled D. right-angled E. scalene.

27. This long chain lines are used in Technical Drawing to indicate A. breakages B. centres C. cutting planes D. limitations E. outlines.

28. The name of a figure with all sides and interior angles equal is triangle. A. acute angled B. equilateral C. isosceles D. right angled E. scalene.

29. Which of the following is NOT a Technical Drawing equipment?

A. caliper B. French curve C. pairs of compass D. protractor E. scale rule .

30. Lines that meet at 90^0 are called -------- lines A. horizontal B. inclined C. paralled D. perpendicular E. vertical.

31. Materials that break easily into pieces are said to be A. bristle

B. conductive C. ductile D. elastic E. fusible.

32. The hand tool used for cutting this sheets of metal is called A. bench vice B. cross-cut chisel C. folding bar D. snip E. stake.

33. The materials that allow the passage of elections through them are called

A. conductor B. charges C. elements D. insulator E. neutrons

34. The electrical consumption in our homes is measured by IBEDC in A. kilo watt B. Mega watt C. Micro watt. D. Mill watt. E. Unit watt.

35. What is the S. I. unit of energy? A. Amperes B. Columb C. Joules

D. Volts E. Watts.

36. Ohm is the unit of ---------- A. current B. force C. power

D. resistance E. voltage

37. The refrigerator works on the principle of

A. Condensation B. Distillation C. Evaporation D. Filteration

E. Sublimation.

38. The repair work carried out to avoid total breakdown of an equipment is called -------- maintenance.

A. Corrective B. Periodic C. Predictive D. Preventive E. Routine

39. The following are sources of energy EXCEPT

A. Sand B. Sun. C. Water D. Wave. E. Wind

40. Which of the following form of energy is used by all machinery? A. Heat

B. Light. C. Mechanical D. Sound. E. Wave.

AppendixJ

Model Answer to BTAT Delayed Post-Test

Item No	Correct Option	Item No	Correct Option
1	A	21	C
2	A	22	C
3	A	23	A
4	A	24	D
5	A	25	B
6	B	26	B
7	C	27	C
8	A	28	B
9	E	09	A
10	C	30	E
11	A	31	A
12	B	32	D
13	C	33	A
14	A	34	A
15	E	35	C
16	B	36	D
17	B	37	A
18	D	38	D

1 9	B	3 9	A
2 0	B	4 0	C

AppendixK

Achievement Score of Experimental and Control Groups and SPSS Computation

Experimental Group

N =58; Males = 30 Females = 28

S/N	Sex	Pre-test	Post-test	Delayed Post test
1.	F	15	40	50
2.	F	30	38	45
3.	F	23	52	55
4.	M	50	65	72
5.	F	20	45	50
6.	M	23	37	45
7.	F	20	50	56
8.	F	25	50	51
9.	F	38	63	68
10.	M	40	70	72
11.	F	25	52	60
12.	M	40	62	70
13.	F	33	62	68
14.	M	23	38	50
15.	F	25	56	60
16.	F	18	37	50

17.	M	23	58	65
18.	M	35	58	68
19.	F	38	60	62
20.	F	30	75	79
21.	M	38	65	72
22.	M	33	50	65
23.	M	28	53	60
24.	F	35	68	75
25.	M	20	55	60
26.	F	30	65	80
27.	F	23	58	70
28.	F	30	65	72
29.	F	20	50	60
30.	F	40	55	85
31.	M	28	53	60
32.	F	55	85	88
33.	F	20	50	65
34.	M	43	68	72
35.	F	38	60	70
36.	M	30	75	80
37.	F	45	70	80
38.	F	23	63	70

39.	F	28	56	60
40.	F	20	52	65
41.	F	13	40	50
42.	M	38	62	70
43.	M	48	70	80
44.	F	15	20	40
45.	M	20	20	45
46.	M	45	70	75
47.	M	30	40	42
48.	M	25	50	60
49.	M	38	60	73
50.	M	23	42	52
51.	M	30	60	71
52.	M	25	55	67
53.	M	52	85	87
54	M	47	67	75
55.	M	35	69	76
56	M	20	51	67
57.	M	40	75	85
58.	M	43	74	78

Control Group

N = 56 Males = 24 Females = 32

S/N	Sex	Pre-test	Post-test	Delayed post test
1.	M	35	30	32
2.	F	25	27	26
3.	M	20	31	32
4.	F	38	28	20
5.	M	33	35	36
6.	M	50	50	55
7.	M	23	34	30
8.	M	30	23	25
9.	M	33	36	32
10.	M	38	38	35
11.	F	28	25	36
12.	M	25	30	32
13.	F	20	27	20
14.	M	33	35	33
15.	M	38	36	35
16.	M	40	35	35
17.	M	28	37	30
18.	F	30	32	21
19.	F	20	38	35

20.	M	38	33	30
21.	M	48	35	37
22.	M	38	38	32
23.	M	23	26	20
24.	M	33	30	31
25.	F	25	35	27
26.	M	45	48	37
27.	M	30	33	30
28.	M	48	28	25
29.	F	38	30	32
30.	M	28	43	40
31.	F	33	34	40
32.	M	28	43	45
33.	F	25	33	33
34.	F	28	40	42
35.	M	33	38	35
36.	F	30	33	32
37.	F	31	38	42
38.	F	33	42	46
39.	F	28	36	40
40	F	34	38	36
41.	F	38	42	40

42.	F	34	38		38
43.	F	36	34		38
44.	F	42	40		42
45.	F	34	36		36
46.	F	32	34		30
47.	F	36	38		36
48.	F	30	32		30
49.	F	25	30		30
50.	F	32	30		25
51.	F	40	40	38	
52.	F	20	16		13
53.	F	26	27		26
54.	F	20	20	18	
55.	F	33	35		32
56.	F	25	28		26

AppendixL

This is a correlation co-efficient developed by Rarl Pearson and called Pearson r. This co-efficient is used when the scale of measurement is either the interval or the ratio type. The raw score definition formula for Pearson r is

$$= \frac{N \Sigma XY - \Sigma X \Sigma Y}{\sqrt{(N \Sigma X^2 - (\Sigma X)^2 \ (N\Sigma Y^2 - \Sigma Y)^2}}$$

Where r = Pearson r:

ΣX = the sum of the scores in X – distribution.

ΣY = the sum of the scores in Y – distribution

ΣXY = the sum of the products of X and Y scores

ΣX^2 = the sum of the squared score in X

ΣY^2 = the sum of the squared score in Y

N = the numbered of paired X and Y scores.

Appendix M

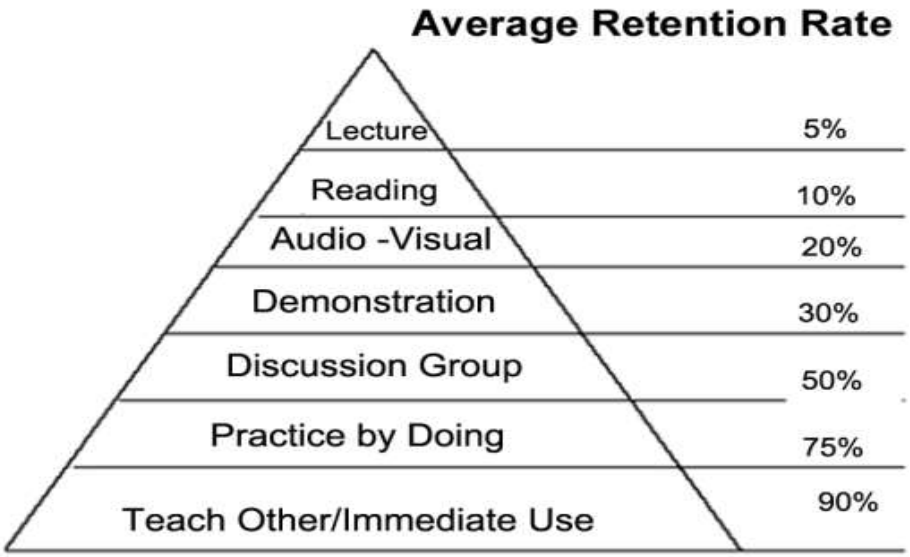
Cooperative Learning and Conventional or Traditional Group Learning

Cooperative Learning	Traditional Group Learning
Positive interdependence with structured goals	No positive interdependence
A clear accountability for individual's share of the group's work through role assignment and regular rotation of the assigned role	No accountability for individual share of the group's work through role assignment and regular rotation of the assigned role
Heterogeneous ability grouping	Homogeneous ability grouping
Sharing of leadership roles	Few being appointed or put in charge of the group
Sharing of the appointed learning task(s)	Each learner seldom responsible for other's learning
Aiming to maximize each member's learning	Focusing on accomplishing the Assignments
Maintaining good working relationship, process-oriented	Frequent neglect of good working relationship, product-oriented
Teaching of collaborative skills	Assuming that students already have the required skills
Teacher observation of students interaction	Little, if any at all, teacher observation
Structuring of the procedures and time for the processing	Rare structuring of procedures and time for the processing

Appendix N

Average Retention Rate

`



Source: Brent 2007

AppendixO

Map of Oyo State

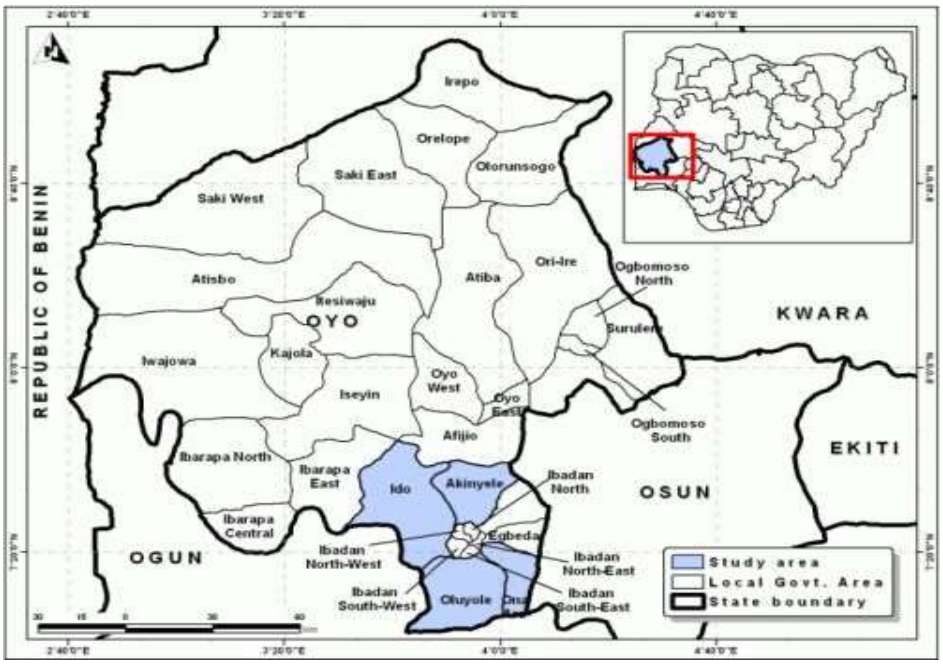
Oyo State is considered as one of the educational advantageous areas in Nigeria, the first premier University, University of Ibadan was located in the state, Ladoke Akintola University of Technology, Ogbomoso, Lead City University Ibadan, Ajayi Crowther University, Oyo. The Polytechnic, Ibadan, City Polytechnic, Ibadan, Tower Polytechnic, Ibadan, Emmanuel Alayande College of Education, Oyo, Federal College of Education (Special), Oyo.

Among others.The researcher proposes this area due to availability of many junior secondary schools and this kind of research has not been undertaken in these districts on basic-technology.

A MAP OF OYO STATE SHOWING THE THREE SENATORIAL DISTRICT

Map of Oyo State

A MAP OF OYO STATE AND IT'S NEIBGHOURING STATES



A MAP OF NIGERIA SHOWING DEPICTION OF OYO STATE

AppendixP

Performance of Students in Basic Technology in all the Junior Secondary School of Oyo State between 2010 to 2015.

Year	Number Enrolled	Number of Passes			Number of Failures
		(A1-A3)	(CA-C6)	(P7-P8)	F
2010	13395	11(%)	28(%)	55(%)	26(%)
2011	13367	13(%)	22(%)	37(%)	28(%)
2012	13528	12(%)	20(%)	33(%)	35(%)
2013	13640	16(%)	22(%)	37(%)	25(%)
2014	14789	16(%)	21(%)	38(%)	25(%)
2015	16928	17(%)	31(%)	38(%)	14(%)
TOTAL	**85647**	**85**	**144**	**238**	**153**

Sources: **Oyo State Ministry of Education Agodi Ibadan, Oyo State.**

Appendix Q

TABLE OF SPECIFICATIONS FOR BASIC TECHNOLOGY ACHIEVEMENT TEST

(BTAT)

COURSE CONTENT	KNOWLEDGE	COMPREHENSION	APPLICATION	ANALYSIS	TOTAL
You and Technology	1	1	2	1	5
Safety	1	1	2	1	5
Material and Processing	_	1	1	_	2
Drawing Practice	2	2	2	2	8
Tools and Manchine	1	1	1	_	3
Applied Electricity and Eleectronics					

	1	1	1	_	3
Energy and Power	2	3	3	2	1 0
Maintainance and Building	1	1	1	1	4
T o t a l	9	1 1	1 3	7	4 0

The four levels of learning given in the tables of specifications (knowledge, comprehension, application and analysis) refers to subdivisions of the cognitive domain of taxonomy of educational objective, since written examinations are usually concerned with assessing the attainment of objectives in the cognitive domain

AppendixR

Data Analysis using SPSS

Research Question 1 and Hypothesis 1

G r o u p S t a t i s t i c s

Post-test	N	M e a n	Std. Deviation	Std. Error Mean
Control Group	5 6	33.9464	6 . 2 7 6 7 1	. 8 3 8 7 6
Experimental Group	5 8	56.7931	1 3 . 4 9 3 0 2	1 . 7 7 1 7 2

T e s t s o f B e t w e e n - S u b j e c t s E f f e c t s

Dependent Variable:post-test scores of control and experimental groups

S o u r c e	Type III Sum of Squares	d f	Mean Square	F	S i g .
Corrected Model	14871.582[a]	1	14871.582	132.778	. 0 0 0
I n t e r c e p t	1389.473	1	1389.473	12.406	. 0 0 1
G r o u p	14871.582	1	14871.582	132.778	. 0 0 0
E r r o r	12544.357	1 1 2	112.003		
T o t a l	264153.000	1 1 4			
Corrected Total	27415.939	1 1 3			

a. R Squared = .542 (Adjusted R Squared = .538)

Research Question 2 and Hypothesis 2

Group Statistics

Methods	N	Mean	Std. Deviation	Std. Error Mean
Conventiona	56	32.6786	7.54166	1.00780
cooperative	58	65.4828	12.01204	1.57726

Tests of Between-Subjects Effects

Dependent Variable:Mean Retention scores of control and experimental groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4065.173[a]	1	4065.173	11.998	.001
Intercept	52437.667	1	52437.667	154.768	.000
Groups	**4065.173**	**1**	**4065.173**	**11.998**	**.001**
Error	37947.353	112	338.816		
Total	319858.000	114			
Corrected Total	42012.526	113			

a. R Squared = .097 (Adjusted R Squared = .089)

Research Question 3 and Hypothesis 3

Group Statistics

	High and Low	N	Mean	Std. Deviation	Std. Error Mean
Pre-test Scores in Experimental Group	Low Scores	45	26.6667	6.97398	1.03962
	High Scores	13	45.2308	4.95234	1.37353

Group Statistics

	Post-test Scores in Experimental Group	N	Mean	Std. Deviation	Std. Error Mean
Post-test Scores in Experimental Group	Low Scores	6	31.6667	9.04802	3.69384
	High Scores	52	59.6923	10.61176	1.47159

Group Statistics

	Pre-test Scores of Control Group	N	Mean	Std. Deviation	Std. Error Mean
Pre-test Scores of Control Group	Low Scores	49	30.0816	5.51829	.78833
	High Scores	7	44.7143	4.11154	1.55402

Group Statistics

	Post-test Scores of Control Group	N	Mean	Std. Deviation	Std. Error Mean
Post-test Scores of Control Group	Low Scores	47	32.1915	5.02878	.73352
	High Scores	9	43.1111	3.58624	1.19541

Tests of Between-Subjects Effects

Dependent Variable:High and Low Pre-test and Post-test scores-Experimental Group

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	24945.741[a]	1	24945.741	261.042	.000
Intercept	55.907	1	55.907	.585	.446
VAR00002	24945.741	1	24945.741	261.042	.000
Error	10894.086	114	95.562		
Total	258484.000	116			
Corrected Total	35839.828	115			

a. R Squared = .696 (Adjusted R Squared = .693)

Research Question 4 and Hypothesis 4

Group Statistics

	Male and Female	N	Mean	Std. Deviation	Std. Error Mean
Post-test Scores of Male and Female students in Control Group	Male	24	35.2083	6.35185	1.29657
	Female	32	33.0000	6.14870	1.08695

Group Statistics

	Male and Female	N	Mean	Std. Deviation	Std. Error Mean
Delayed post-test scores in Control Group	Male	24	33.5000	6.82068	1.39227
	Female	32	32.0625	8.09196	1.43047

Group Statistics

	Male and Female	N	Mean	Std. Deviation	Std. Error Mean
Post-test Scores in Experimental Group	Male	30	58.0667	13.84628	2.52797
	Female	28	55.4286	13.21735	2.49784

Group Statistics

	Male and Female	N	Mean	Std. Deviation	Std. Error Mean
Delayed Post-test Scores in Experimental Group	Male	30	66.9000	11.52613	2.10437
	Female	28	63.9643	12.54173	2.37016

Tests of Between-Subjects Effects

Dependent Variable: Scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5676.735[a]	3	1892.245	8.336	.000
Intercept	381.874	1	381.874	1.682	.197
Gender	**1064.584**	**1**	**1064.584**	**4.690**	**.032**
Group	219.105	2	109.552	.483	.618
Error	24968.282	110	226.984		
Total	216582.000	114			
Corrected Total	30645.018	113			

a. R Squared = .185 (Adjusted R Squared = .163)

Research Question 5 and Hypothesis 5

Group Statistics

	Male and Female	N	Mean	Std. Deviation	Std. Error Mean
Post-test Scores of Male and Female students in Control Group	Male	24	35.2083	6.35185	1.29657
	Female	32	33.0000	6.14870	1.08695

Group Statistics

	Male and Female	N	Mean	Std. Deviation	Std. Error Mean
Delayed post-test scores in Control Group	Male	24	33.5000	6.82068	1.39227
	Female	32	32.0625	8.09196	1.43047

Group Statistics

	Male and Female	N	Mean	Std. Deviation	Std. Error Mean
Post-test Scores in Experimental Group	Male	30	58.0667	13.84628	2.52797
	Female	28	55.4286	13.21735	2.49784

Group Statistics

	Male and Female	N	Mean	Std. Deviation	Std. Error Mean
Delayed Post-test Scores in Experimental Group	Male	30	66.9000	11.52613	2.10437
	Female	28	63.9643	12.54173	2.37016

Tests of Between-Subjects Effects

Dependent Variable: Scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	15037.955[a]	2	7518.978	67.427	.000
Intercept	1473.437	1	1473.437	13.213	.000
Treatment	14477.487	1	14477.487	129.827	.000
Groups *Gender	**166.373**	**1**	**166.373**	**1.492**	**.225**
Error	12377.983	111	111.513		
Total	264153.000	114			
Corrected Total	27415.939	113			

a. R Squared = .549 (Adjusted R Squared = .540)