EFFECT OF COOPERATIVE LEARNING STRATEGY ON ATTITUDE AND ACADEMIC PERFORMANCE OF BIOLOGY STUDENTS OF DIFFERENT COGNITIVE STYLES IN KADUNA STATE, NIGERIA

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF DOCTOR OF PHILOSOPHY IN SCIENCE EDUCATION

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DECLARATION

I declared thatthis thesisentitled “Effect of Cooperative Learning Strategyon Attitude and Academic Performance of Biology Students of Different Cognitive Styles” has been written by me, Sunday Ayuba ABUBAKAR (P16EDSC9069). The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at this or any institution.

..... ……..

Sunday Ayuba ABUBAKAR DATE

CERTIFICATION

This thesis,entitledEFFECT OF COOPERATIVE LEARNING STRATEGY ON ATTITUDE AND PERFORMANCE OF BIOLOGY STUDENTS OF DIFFERENT COGNITIVE STYLE bySunday AyubaABUBAKAR meets the requirements governing the Award of the degree of Doctor of Philosophy (PhD) in Science Education of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation

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DEDICATION

This thesis is dedicated to my father, Ayuba Abubakar Kato on whose library this academic journey began.

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ABBREVIATION USED

GEFT	-	Group Embedded Figure Test
GPT	-	Genetic Performance Test
CLAS	-	Cooperative Learning Attitude Scale
FI	-	Field Independent
FD	-	Field Dependent
FIH	-	Field Independent Homogenous Group
FDH	-	Field Dependent Homogenous Group
FDHT	-	Field Dependent in Heterogenous Group
FIHT	-	Field Independent in Heterogenous Group
STAD	-	Student Team Achievement Division

OPERATIONAL DEFINITION

Cognitive Style:	Cognitive style is the relatively stable strategies, preferences and attitudes that determine an individual's typical modes of perceiving, remembering and problem solving.
Field Dependence/Independence:	A Cognitive Style Dimension that describe learners as either Field Dependent or Field Independent
Field Dependent Learners:	Learners that perceived things globally, like working in group and are people oriented.
Field Independent Learners	Learners that perceived things analytically, like working alone and are task oriented.
Homogenous Grouping:	A Grouping Pattern that put subjects with the same Cognitive Style in a group.
Heterogeneous Grouping:	A Grouping Pattern that put subjects of different Cognitive Style in a group.

ABSTRACT

The study was carried out to determine the effect of cooperative learning instructional strategy on the attitude and performance of SSII biology students of different cognitive styles in Giwa educational zone Kaduna State Nigeria. The design is a pretest posttest/quasi experimental design. The population of the study comprises all the private secondary schools in the zone.The total number of students was 1,915. Four schools were purposively selected to serve as experimental and control school respectively. Four intact classes were used.The sample comprises 92 students. Three instruments were used to generate the data. Group Embedded Figure Test (GEFT) with a reliability coefficient of 0.87 was used to establish the cognitive style of the subjects. The Genetic Performance Test (GPT) and the Cooperative Learning Attitude Scale (CLAS) with a reliability coefficient of 0.76 and 0.83 respectively were used to measure the performance and the attitude of the subjects after treatment. The experimental groups were taught using cooperative Learning Instructional Strategy while the control group was taught using the lecture method. Data collected were analysed using descriptive statistics, t –test and Analysis of Variance (ANOVA) at 0.05 level of significance. The result revealed, (a) A significant difference in the mean performance score between the cooperative learning group and the lecture group (b) no significant difference between field dependent subject and field independent subject in both homogenous and heterogeneous groups (c) No significant difference in the attitude of field dependent and field independent in both homogenous and heterogeneous groups. Based on these finding, it was concluded that cooperative learning instructional strategy enhanced the performance of senior secondary school students of both field dependent and independent cognitive style in genetics. The following recommendation were made (a) Cooperative Learning Instructional Strategy should be used to help the field dependent learners learn effectively (b)Workshops and seminars should be organized to train teachers on how to teach using different cooperative learning models (c) cooperative learning instructional strategy could be used to motivate learners learn biology in secondary school.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

There is a global awareness of the need to improve the quality of Science and Technology Education at all levels of education. In Nigeria, like most developing nations of the world, efforts are being made by the government and professional organizations towards achieving not only scientific literacy and qualitative science and technology education for few of the populace but to promote acquisition of scientific and technological culture by all and sundry (Lakpini, 2010).Agbowuro (2008) also supported this when he reported that the need to improve the quality of science teaching and learning for citizens so that they develop scientific literacy to cope with the demands of science andtechnology growth has been the yearning of every nation in this 21 century.The WAEC analysis results in core science subjects from 2010 – 2014 revealed dismal failure. Falalu(2015) supported this position when he reported; there is a consensus on the poor performance in science in senior secondary schools examination.

Over the years, science educators and researchers in sciences education have intensified their effort to seek a clearer understanding of the issues involved in the declining performance of students in science (Ogunmade, 2005). According to Lakpini (2010), series of innovations have attempted to upgrade and improve the teaching and learning of science in schools. In her opinion, the major aim of this reform is to shift from the traditional expository method of teaching/ learning that emphasizes memorization of facts of science, to inquiry, interactive, cooperative oriented

approaches that facilitate conceptual understanding and metacognitive capacity of the learners. The author stressed that many of these educational reforms advocate the use of hands - on instructional designed to promote students conceptual knowledge in a manner that encourages problem solving (Lakpini,2010). Chinwen (2008), observed that, the responsibility of a biology teacher is not only the effective presentation of biology subject matter but also ensuring that everything that goes on in the classroom is of maximum benefit in promoting all round development of the student. Agbowuro (2008)pointed out that the overriding objectives of biology teaching is to ensure that students learn biological concepts meaningfully. Kajuru and Popoola (2010), in their contribution suggest that meaningful learning of concept can only take place when effective pedagogical strategies are employed in teaching. They describe pedagogical strategies as teaching strategies and styles which allow teacher to present his lessons in a stimulating ways. They added that, the strategies involve moving from traditional method which encourages rote learning to student activities involving applying and understanding of concepts.

Instructional strategies recently emphasized by researchers include: Guided discovery (Moreno, 2004, Kajuru&Popoola, 2010), problem solving (Orlich et al, 2010, Olalekan and Jerome, 2006), conceptual change (Lakpini, 2010), Teaching cycle (Bello 2011), Computer Assisted Instruction (Bunkure, 2007,) and Co-operative learning (Oloyede and Ojo, 2006; Olorukooba, 2001, Dyel, 2011). Co-operative learning instructional strategy is a set of instructional strategy used to help learners meet specific learning and social interaction objectives in structured group (Kaukhak and Eggen, 2011). According to Lam(2005), Cooperative learning is a student-

centered, instructor-facilitated instructional strategy in which a small group of students is responsible for its own learning and the learning of all group members. Co-operative learning is one approach in providing collaborative opportunities for students of biology. It is a theoretically grounded and a well-researched approach that has been proved to increase students learning of subject matter and improve their attitude towardlearning in general and subject matter specifically (Springer et al 1999; Johnson et al, 2000).According to Ornelas (2004), teachers must engage students so that they could retain and comprehend the subject matter taught in classroom, and provide them with the appropriate social skills needed to succeed beyond the classroom environment. She also argued that a learning method that educators can use to help students develop both academic learning and social skills is called co-operative learning teaching strategy. Co-operative learning is considered to be an effective way of instruction and has been introduced in educational systems throughout the world, including: The United State of America, Canada, England, Saudi Arabia, New Zealand, Turkey, Panama, Singapore and Hungary (Ysseldyke, 2002). Several studies pointed to the effectiveness of cooperative learning across different disciplines. For instance in English(Ren-shing's 2006, Ghazi, 2003), Mathematics (Fengfeng and Barbara, 2007), chemistry(Samuel and John 2004, Burcinand& Leman, 2007), physic (Dimitrios, etal. 2006) biology(Lords, 2001,Pandian ,2004&Lawrence ,2006)

Several empirical studies however, showed that Individuals learn in different ways (Kajuru and Popoola, 2010). These learning differences are often described as Psychological differentiation, learning preference, learning patterns, learning style and cognitive style (Riding, 2000Sara, 2010; Vermunt&Vermetten, 2004, Dunn, 2003).

There appear, considerable disagreement in the literature concerning the terms cognitive and learning styles. Numerous authors and researchers however, use them interchangeably (Altun and Cakan, 2006). However, Messick (1994), in his report, defined cognitive style as the manner in which people prefer to make sense out of their world by collecting, analyzing, evaluating and interpreting data. Keefe (in Wyss, 2002) attempts to draw a line between learning style and cognitive style, he explained that, the way we learn things in general and the particular approach we adopt when dealing with problems is said to depend on somewhat mysterious link between personality and cognition; this link, according to him is called cognitive style. He further clarified that, when cognitive style are related to educational context, they are generally referred as a "learning style". He defined learning style as the cognitive, affective, and physiological traits that are relatively stable indicators of how learners perceive, interact with, and respond to the learning environment.

The concept of cognitive style has continued to be explored in the educational, psychological and organizational research literature for almost 40years (Pither, 2002). In fact, Rudd et al (2000) argues that the success of education hinges on the adaptation of teaching to the learning differences among students.In his contribution, Cao (2006) submits that individual learner differences are believed to be important concern in the design, development and implementation of instructional materials and curricula. According to Altun and Cakan (2006), there are various recognized cognitive styles available in literature, among which are the following:

- visual / haptic,
- visualize/verbalizer,

- leveling/sharpening,
- serialist/holist and
- field dependent /independent .

However, among all cognitive style constructs, field dependent/independent has been acknowledged as the most widely researched (Cao 2006, 2009, Sara, 2010). Adegoke (2011) opined that, Field-dependents (FD) students rely on the surrounding Perceptual field, have difficulty in attending to, extracting, and using non salient cues. Menekse (2012) stated that field-independent (FI) students are able to perceive object asseparate from the field, can dissemble relevant items from non-relevant items within the field. Blanton(2004)describedthe field dependent learners as people oriented while their counterpart were described as task oriented. It can therefore be deduced that, their attitude to group learning might not be the same.

Attitude is another variable in this study. Attitude could be defined as a learner's predisposition to respond positively or negatively to a specific object, situation or person (Aiken, 2000, Orji, 2002).Another important definition was Allports(cited in Mukharjee, 2000). He defined attitude as a mental or neural readiness, organized through experience, exerting a directive and dynamic influence upon individual's response to all objects or situations with which it is related. Thurston cited in Ksheerasagar&Kavyakishore (2013) described the concept of attitude as the sum total of man's inclinations and feeling, prejudice or bias, preconceived notions, ideas, threats and convictions about any specific topic.

According to Owen et al, (2008), declining student interest in science courses and careers is a worldwide concern that has prompted science education reform efforts on

an international scale. Recently, students attitudes have been describe as a critical factor that affects the quality of teaching and learning.

Ksheerasagar and Kavyakishore (2013) pointed out that, attitudes are developed, they are not inborn. They also added that one of the chief objectives of education is the development of desirable attitudes in the students.This agreeswith George (2006) who reported that one of the key factors in learning of science is attitude and the development of positive attitudes towards science can motivate student interest in science education. It is therefore, obvious that the teacher must understand the various dimensions of an attitude and also to develop positive attitude in the student like attitude toward studies, self, colleagues, and certain ideals. It therefore follows that student attitude can be modified by the use of appropriate instructional strategies.Adesoji(2008) in his report suggested that there is a relationship between attitude and method of instruction. Several researches also confirm this as they expose students to computer and text assisted program instruction(Uduosoro,2000), self-learning device(Popoola, 2002), computer assisted instruction(Bunkure,2007), cooperative learning instructional strategy(Dyel, 2011).

However, attitude of FI and FD learners as outlined by Blanton (2004) differs. According to Cakan(2000),FD and FI might not necessarily differ in learning ability but may choose to respond differently to the content being presented as well as the learning environment. Therefore, it is likely when exposed to a learning content and environment; their attitude may be affected differently. Thus, it would be expected that FD being more socially inclined would feel better learning in a group and therefore exhibit more positive attitude. It could also deduce that FI being more

comfortable with little or no teacher supervision might enjoy learning under cooperative learning structure. One can also reasonably, expect a kind of modification in the attitude of FI under a nontraditional learning environment like cooperative learning. Among group members, verbal exchange in a positive interaction arouses group member's interest and even students who are normally apathetic might find it difficult to reject an assign task.Therefore, it is expected that both FI and FD will be favourably predisposed to learning by cooperative instructional strategy and possibly have their achievement enhanced. This study will established this and also determine which of the groups will acquire more positive attitude at the end of the exposure.

Performance, according to Akale (1991) is the level of knowledge, skills, or accomplishment in an area of endeavour's. Poor performance of students in secondary school has been largely attributed to the way the subject is taught. There is increasing awareness in recent years of the importance of learner centeredness and teaching. Aikenhead(2005) and Usman(2008) posited that the degree of academic performance of a student is directly related to the quality of teaching method employed. A number of researches focus on the relationship between instructional strategies, attitude and performance in science (For instance, Nasr 2011,Cheung, 2009)

Generally, it has been documented in research that cooperative learning teaching strategy promotes student (both field dependent and independent) performance outcomes like knowledge acquisition, retention, creativity in problem solving and high level reasoning. Many researchers like Fenfeng and Barbara (2007), Samuel and John (2004), Pandia (2004) and Ghazi (2003), also concurred that cooperative learning teaching strategy promote student performance.

However, owing to the differences already documented between FD and FI, it can be deduced that their attitude and obviously their performance may differ – if they are groupedseparately (homogeneously).Grouping is avery important stage in cooperative learning. It is a group form of learning and in grouping, extra care must be taken to maximize learning. Using different criterion for grouping, two forms of grouping are often emphasized in the literature, these are:

- Homogenous grouping
- Heterogeneous grouping

Homogenous grouping entails grouping students with the same characteristics (i.e, gender, academic ability, cognitive style).Heterogeneous grouping on the other hand entails grouping of students with varying characteristics like gender, academic ability, and cognitive style. According to Ansalone (2000), there seems not to be a clear cut answer as to which type of grouping is most appropriate. However, it can be advocated that, bird of the same feather are most likely going to flock together. Therefore grouping Field dependent (FD) and field independent (FI) students separately in a homogeneous group might lead to better interaction, more positive attitude which might lead to better learning. For instance the FD students, being more people oriented, good in friendship and like working in small group (Blanton, 2004) might be more at home with cooperative learning setting and might exhibit a more positive attitude and higherperformance. Field independent (FI) learners on the other hand, being independent learner, more reflective, analytic in processing information, comfortable with little teachers supervision, unstructured material might find cooperative learning setting interesting and therefore exhibit a more positive attitude.

Homogeneous grouping might also reduce the level of cognitive dissonance due to cognitive similarities. Students of the same cognitive style might have the same attitude and the same behavior and therefore might not experience much disagreement and inconsistencies. However, it can also be argued, according to the cognitive dissonance theory, that, individuals in a heterogeneous group can always strive toward consonance as they interact leading to better understanding of one another views and also better learning. That is disagreement from other members in a group generates dissonance, and subsequent movement toward group consensus reduces this negative tension (Matz and Shepherd, 2004). Specifically this study investigated what would be the attitude and performance of the attitude and performance of field dependent and independentbiology students when taught in both homogeneous and heterogeneous cooperative learning groups.

1.1.1 Theoretical Framework

This study investigated the effect of cooperative learning on the attitude and performance of student of different cognitive style. In other words, what wouldbe attitude and achievement of field dependent (FD) andfield independent (FI) studentstaught genetics using cooperative learning instructional strategy. The study was anchored on three theories, namely: VygotskysTheory of Social Interaction, Piaget Theory of Cognitive Elaboration and Witkin Theory of Field Dependence and Independence Cognitive Style.

Vygostky, (1962), Russian teacher and psychologist, first stated that we learn through our interactions and communications with others. He further examined how our social environments influence the learning process. He suggested that learning takes place

through interactions students have with their peers, teachers and other experts.The major theme of Vygotsky's theoretical framework is that social interaction plays a fundamental role in the development of cognition. Vygotsky (1978) states, "Every function in the child's cultural development appears twice: First, on the social level and later on the individual level, first between people (inter-psychological) and then inside the child (intra-psychological)".

According to McLeod (2007), like Piaget, Vygotsky believes that young children are curious and actively involved in their own learning and the discovery and development of new understanding/scheme. However, Vygostsky placed more emphasis on social contribution to process of development. Vygotsky (1978) maintained that much important learning by the child occurs through social interaction with skillful tutor. The tutor may model behaviors and/or provide verbal instructions for the child. Vygotsky refers to this as coo-operative or collaborative dialogue. The child seeks to understand the actions or instructions provided by the tutor (often the parent or teacher) then internalize the information, using it to guide or regulate their own performance.

According to McLeod (2007), two main principles are crucial in understanding Vygotsky theories on cognitive development, the more knowledgeable others (MKO) and the zone of proximal development (ZPD). He explained that the MKO refers to someone who has better understanding than the learner, with respect to a particular task, process or concept. He however, posited that, the MKO must not necessarily be a teacher or an older adult. He could be a child's peers with more knowledge or

experience.The concept of more knowledgeable other (MKO) is integrally related to the concept of zone of proximal development.

According to McLeod (2007), zone of proximal development, is a concept that relates to the difference between what a child can achieve independently and what a child can achieve with guidance and encouragement from a skilled partner. Vygotsky (1978) sees the zone of proximal development as 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 function.

Vygotskys proposal does support cooperative learning teaching strategy. Cooperative learning teaching is structured in a way to promote heterogeneity of academic ability level. This structure enables the higher ability students in a group to help in explanation of a concept, problem solving and learning of some social skills that will promote academic achievement. The concept of positive interdependence in cooperative learning ensures that all group members should assist each other believing that the group either swim or sink together.

Piaget's theory of cognitive development suggested that cognitive development leads to learning. Cognitive development is a progressive reorganization of mental processes as a result of biological maturation and environmental experience (Mcleod, 2012). Kauchak and Eggen (2011), refers to cognitive development to changes in students thinking as they mature and acquire experiences.

According to Piaget(1970), construction of knowledge is a process of interaction between the individual and the environment. He maintained that as individual interact with the environment, innate mental structures are reorganized as

gaps and contradictions are reorganized. Piaget called this equilibration or self-regulation. This triggers the process of assimilation and accommodation. When information are presented that individual can construct cognitive structure that recognized or give meaning to it, the information is assimilated into the individuals cognitive system. In event that the new information contradicts the current cognitive structure, the system or schema must be restructured or modified to better fit the new information in a process called accommodation. Thus, through accommodation, the new information can be assimilated into a new cognitive system that is ever growing in complexity. It can be deduce that, collaborative interaction with colleague will help to raise these cognitive conflicts which can easily resolved and assimilate knowledge through mutual interaction or discussions with members of the group.

The field-dependent/independent (FDI) cognitive theory is another theory that supported this study. The construct was created by Witkin and Asch (Witkin, 1950; Witkin& Asch, 1948) during studies they conducted concerning how individuals perceive themselves in space. They contended that individuals have different cognitive styles according to each individual's way of disembedding figures from the distracting surroundings. A field independent person tends to perceive surroundings analytically, separating objects discretely from their backgrounds, while a field dependent person tends to perceive things in a relatively global fashion, being easily influenced by a prevailing field or context (Witkin, et al., 1971). Field independent(FI) have been shown to be more comfortable in a learning environment where they have the opportunity to re- structure, re- organize and represent information presented to them, perform better in science related courses, be more reflective, more analytic in

processing information, less sociable, cold and distant in relationship.Field dependent individual (FD) on the other hand, may prefer more direct instruction or definition of the material in situations that involve re-structuring abilities ((Blanton, 2004, Korckar, 2010; Fyle, 2010). However, Fyle(2010) also supported this when he reported that, FD students are more comfortable with learning environment where the information presented to them has already been structured and organized for their learning – and this is rarely the case in a cooperative learning environment.

From the above description, one could possibly argue that field dependent (FD) students group(homogenous) will have positive attitude to cooperative learning teaching setting and might possibly end up having positive attitude and consequently high achievement score. For they will be at ease working on task and interacting with one another leading to cognitive restructuring and better understanding. On the other hand, It could also be deduce that field independent (FI) could improve in their social skill and be more open and at home with others leading to more positive attitude to group learning. This coupled with other advantage they enjoyed might also lead to better achievement. This study is set therefore to investigate the performance and attitude of field dependent (homogeneous) and field independent (homogeneous) group biology students in Giwa educational inspectorate.

1.2 Statement of the Problem

Our current educational system is based upon competition among students for grades, social recognition, scholarship and admission to schools (Kolawole, 2008). This is because competition for grades is seen as a major motivation for sustaining

students' active participation and self-regulation in learning. Recent findings(i.e, Johnson & Johnson,2005 Slavin,2011) suggest that learners interest and motivation in learning could be greatly enhanced when they are allowed to learn cooperatively in groups than in a competitive atmosphere. This provides an atmosphere that gingers corporate learning through interdependence among learners. This provides an opportunity for the weak student to seek assistance from their more able colleagues to enhance their performance.

Studies show that effective learning in groups is more when learners have acquired skills required for group activity from individuals of either same ability or learning/cognitive style. This tends to suggest that grouping chosen could be a factor in learning. There is a controversy that students could learn better from colleagues of same ability and especially learning style. This calls for research to establish if differential grouping of students according to cognitive style would lead to difference in their attitude and achievement. This study therefore will like to find out what would be the achievement and the attitude of FD and FI students if grouped homogeneously or heterogeneously in a cooperative learning setting. In other word, which of the group (FD or FI) would have more positive attitude and higher performance score when taught using the cooperative learning instruction. Theinstruction in particular will focus on the concept of genetics. The concept of genetics has been described as difficult by several researchers (Chima and Onyebuchi, 2010, Bello, 2011).

1.3 Objectives of the Study

The objectives of the study include the following;

- To find out if cooperative learning instructional strategy has effect on the performance of SSII biology students.
- To find out if cooperative learning instructional strategy has effect on the performance of field dependent (FD)and field independent SSII biology students in homogenous and heterogeneous Group or not
- To determine if cooperative learning instructional strategy has effect or not on the attitude of the FD and FI student both homogeneous and heterogeneous group.

1.4 Research Questions

1. What is the difference in student mean performance scoresof students exposed to Cooperative Learning method and those exposed to Lecturegroup?
2. What is thedifference between the mean performance score of field dependent and field independent in homogenous group and their counterpart in the heterogeneous group?
3. What is the difference between the mean attitude score of field dependentand field independent in the homogenous Group and their counterpart in the heterogeneous group?

1.5 Null Hypotheses

1. There is no significant difference between the mean performance score of students taught in Cooperative Learning group and those taught in Lecture Group.

2. There is no significant difference between The mean performance score of field dependent and field independent in the homogenous group and their counterpart in the heterogeneous Group

3. There is no significant difference between the Mean attitude Score of field dependent and the field independent in the homogenous group and their counterpart in the heterogeneous Group.

1.6 Significance of the Study

In an effort to improving the teaching and learning of science in our secondary schools, this research, will help in the following ways:

1) **Students:** The study will help to develop in the participating students social skills which are essential for effective and gainful interaction in schools and communities.

2) **Biology Teacher:** It will serve as a brochure that gives teachers specific guidelines on how to execute lessons using cooperative learning teaching strategy.

3) **Teachers:** The study will also afford the field dependent students the opportunity to learn together and interact socially. If the modes of grouping used are found to be effective, teachers will adopt them to enhance the effectiveness of cooperative instruction.

4) **School Authority:**The study if fruitful will be recommended for implementation.

5) **Researchers:**The empirical data that will be generated from this study will add to theexisting research data base and this could benefits other researchers that will embark on related research.

1.7 Scope of the Study

This study investigated the effect of cooperative learning instructional strategy on the performance and attitude of SSII biology students of different cognitive style in Giwa educational inspectorate division. The study shall be limited to SSII Biology students within the Inspectorate Division. The choice of SSII was guided by the fact that they are a more stable class with little distraction.SSII unlike SSI have fully adjusted to senior secondary school and unlike SSIII student are not writing external examination (i.e., WAEC or NECO).The cooperative learning instruction as well as the traditional instruction will focus on the concept of genetics.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

The title of this research work is the Effect of Cooperative Learning Instructional Strategy onAttitude and Achievement of SS II Biology Students of Different Cognitive Style in Giwa Educational Zone. ThisChapter presents a summary of research literature and reports that are relevant to this study.The chapter is presented under the following subheadings:

2.2 Different Approaches to Science Teaching

2.2.1 Traditional Teaching Method

2.2.2 Constructivist Teaching Approach

2.3Cooperative Learning Strategy

2.3.1 Features of Cooperative Learning

2.3.2 Models of Cooperative Learning

2.3.3 Homogeneous and Heterogeneous Grouping Pattern in Cooperative Learning

2.4 Cooperative Learning Strategy and Attitude

2.5 Cooperative Learning Strategy and Student Performance

2.6 Cooperative Learning Self Efficacy and Cognitive Style

2.7 Style Construct

2. 7.1 Field Dependency and Independency Cognitive Construct

2.8 Overview of Literature Review

2.9 Implications of Literature review for the Study

2.2 Different Approaches to Science Teaching and Learning

Teaching is helping learners to acquire new knowledge or skills (Lakpini, 2010).The primary purpose of teaching at any level of education is to bring a fundamental change in the learner (Tebabal & Kahssay, 2011). Lakpini(2010) opined that a science teacher has a variety of methods and techniques available for use in the classroom. She however, pointed that the selection of a suitable method is based on the objectives of the lesson, needs of the learner and nature of the content. Teaching methods work effectively mainly if they suit learner's needs since every learner interprets and responds to questions in a unique way. For instance, field dependent learner (FD) are often at home with group work, whereas field independent (FI) prefer studying in isolation. It therefore follows that alignment of teaching methods with students needs and preferred learning style might influence students' academic performance. Teaching methods often emphasized in literature include: Lecture method, Demonstration method, Concept mapping, Discovery/Inquiry, Project method, Problem solving, Scaffolding, cooperative learning teaching strategy and computer assisted instruction (Uchenna and Osokoya, 2011).The following methods are widely used in science instruction:

2.2.1 Traditional Teaching Method

Traditional teaching method is a teacher centered method (Lakpini, 2012). The teacher in this method does the bulk of the talking as he present large body of facts and principle to many students whose roles are relegated to that of a passive learners.For Adegoke (2011) in a separate study observed that most classes involve

rote learning, in which there is dependence on memorization devoid of the understanding of the subject. Uchenna and Osokoya(2011) posited that, traditional teaching method includes method like: Lecture Method, Demonstration Method, and Analogy.Lakpini, (2012) however,opined that this mode of teaching is commonly used by most teachers in Nigerian schools from primary to tertiary level of education. In traditional teaching according to Ogunmade (2005), a teacher plays an important role in the instructional active ties. She described the teaching style as highly teacher-driven. The teacher usually dominates and just gives out facts and principles on a topic to the learners (i.e. one way flow of information from the teacher).

The method hasbeen condemned seriously because it makes the learners passive listeners and does not take cognizance of the learners' language competence or learning difficulties. Traditional teaching method encourages rote learning which is one of the factors militating against effective science teaching and learning (Baike, 2000). In fact, Lakpini(2006) attributed the low percentages passes in biology to the use of this method of teaching. Many researches, in their design, use the traditional teaching approach as control to investigate the efficacy or the effect of an evolving instructional strategy. For instance, Olorukooba(2001) compared cooperative learning teaching strategy and the traditional teaching method. In the same vein, Bello (2011) compared the learning cycle instructional strategy to the traditional teaching method. In all the researches cited, the traditional method of teaching have been shown to be comparatively less effective to other instructional strategy like cooperative learning, conceptual change instructional strategy.

However, the traditional teaching method is never without its advantage. According to Okwilagwe (2002), lecture method allows a great deal of information to be passed to the learner and favour handling of large class. This agreed with the report of Olorukooba(2001) which maintained that the main advantage of this method is its economical mode of instruction in which the teacher/lecturer presents in personalized, continuous and systematic manner; a large body of knowledge to his audience. The method, if used with demonstration, effective questioning, use of advance organizers among others, can be enriching. It can also be argued that students that have acquired formal reasoning might be comfortable under the lecture method (Shuaibu and Mari,2003).

2.2.2 Constructivist Teaching Approach

Constructivism is a subset of cognitive perspective (Orlich, Harder, Callahan, Trevisan and Brown 2010). Researchers in recent years in science teaching and learning have recognized constructivism as an influential approach for developing scientific literacy (Rechardson, 1997 and Tyler, 2002). Gagnon and Collay (2001), Richardson (2003) posited that constructivism is not a monolithic philosophy or methodology. It encompasses a range of beliefs and pedagogical approaches. Constructivism views learners as thinking beings, who are mentally active in attempts to gather information, organize it to make sense of it, and store it in memory for future use (Kauchak and Eggen 2011).Tyler (2002) however, views constructivist learning as one wherein; learning outcomes depend on the learning environment and the knowledge of learner. He suggests that learning involves the construction of meaning

and construction of meaning is a continuous and active process. Constructivism is the educational philosophy that learners must individually discover and transform complex information if they are to make it their own (Slavin, 2000).

Kauchak and Eggen (2011) posited that a normative philosophy influenced by constructivism recommends that teachers provide students with experiences and then guide them in the process of constructing a valid understanding by those experiences.John Dewey was perhaps the first philosopher or educator to ponder constructivism.Dewey sees education as a constant re-organization or reconstruction of experience. However, Slavin (2000) pointed out that Piaget and Vygotsky are generally credited with the cognitive development theories that led to constructivism.Lam (2011) opined that, there is no specific constructivist pedagogy. However,he explained that we can conclude the principles that guide the development of constructivist pedagogies, by comparing it with traditional behaviourist perspective of teaching.

Table 2.1: Constructivist Pedagogies vs.Traditional Pedagogies

Dimensions/Approaches	Constructivist Learning	Traditional Learning
Nature of learner	Sees learners as unique individuals; the unique nature of learners is an integral part of the learning process	Sees learners as homogenous mass defined by chronological age upon which learning targets and materials are designed in the curriculum; learners are expected to meet the nominal standard
Responsibilityfor learning	Resides with the learner; emphasizes the active role of learners in the learning process in looking for meaning	Rests with the teacher; learner is passive and receptive; learners present what they learn from teachers
Learning motivation	Develops learners' motivation through authentic experiences in handling problems; by gaining success, learners gain confidence and motivation to embark on more complex challenges; intrinsic	Learners' behaviors are reinforced by praises and rewards; learners increase motivation by conforming to standards and expected achievements; extrinsic
Role of Teacher	Usually asks, supports, provides guidelines, and creates environment for learners to arrive at their own conclusions; continuous dialogue with learners; teacher should challenge learners	Often gives instructions from the front; gives answers and expects learners to be disciplined in receiving the content of the curriculum with the least distraction and disturbances; learners are under control in the learning process
Interaction	Teachers and learners learn from each other; learners compare their version of truth with that of teachers and peers to arrive at a socially tested/socially negotiated version of truth; learning task is the interface between teachers and learners, both should develop awareness of each other's viewpoints and should look at their own standards and values	The learning experience is objective; learners receive truth and knowledge from teachers through given tasks; the teacher is an expert who gives expert advice and instruction to get learners gain knowledge efficiently
Collaboration	Learners collaborate to arrive at a shared understanding of truth in a specific field; through "scaffolding," learners can extend beyond the limitation of physical maturation to the extent that the development process lags behind the learning process	Learners should be attentive and disciplined to achieve the content set in the curriculum; they should try hard to fulfill expectations from teachers; students seek advice from teachers in their study

Adapted from: Lam, B. H. (2011).

The above description agreed with cooperative learning teaching environment. Lord(2001) reported that interacting with peers in cooperative learning uncovers inconsistencies in what both the explaining students and the listening students already know about a topic. As they discuss with their team members, students make adaptation in their understanding. It is also part of the cooperative learning structured that students ask their teammates first before asking the teacher. The teacher takes the role of a facilitator, guiding the students as they construct new knowledge through discussion and interaction with one another. However, constructivism is not an instructional model, nor is it a specific learning model.It is a theoretical model about how a learner comes to know. Many child centered teaching strategies have their roots in the constructivist philosophy. Some of these strategies are discussed below

i. **Discovery/ Inquiry Teaching Approach**

This is an inquiry in which learners pose questions and seek explanation (Orlich et al., 2010). Matson (2006), in his submission describes inquiry discovery based teaching as a process of inquiring the nature and structure of the universe. Kajuru and Popoola(2010), defined discovery teaching strategy as a strategy whereby learners struggle to identify knowledge, facts and ideas by themselves under the guidance of the teacher.Discovery learning is a method that encourages students to arrive at a conclusion based upon their own activities and observations (Balm, 2009).In this teaching strategy, student participation is high. Kajuru and Popoola(2010), maintained that, discovery teaching strategy encourages considerable student participation, involvement and interest more than teacher dominated method.

In fact, Kara and Ozgun – Koca (2000),Kipnis, (2005)reported that the active participation of the learner in the learning process is called discovery learning. Inquiry learning requires active participation of students in the learning process. In discovery learning, student constructs knowledge based on new information and data collected by them in an explorative learning environment (Matson, 2006).Uchenna and Osokoya (2011), affirmed this by reporting that Science was discovered by man, it is an inquiry subject, and it should be taught but students should be allowed to discover science.He further stressed that the discovery/inquiry strategy offers many gain: The learner are actively involved, it caters for retentive knowledge and creativity on the part of the learner. It inculcates scientific attitude, manipulative skill in addition to improved cognition.Harlem (2004), supported this by reporting that inquiry learning in science develops the perception skills of students because it allows them to understand the natural phenomena and the world by using their cognitive and physical skill.

Many researchers have reported the effectiveness of discovery method in teaching and learning of science and mathematics. For instance Kankia (2008) reported that, discovery method is significantly more effective, suitable and productive in teaching and learning Mathematics.Oghenevwede(2010), in a separate study reported that student taught with discovery method achieved high scores and retained more content of the material.

However, it is worth noting that, some of the basic tenets of inquiry method over lapses that of cooperative learning teaching strategy. For instance, in addition to student being active in both the two teaching methods,Orlich et al.(2010) maintained that inthe two methods, students are responsible for planning, conducting and

evaluating their own efforts. It is essential for the teacher to play only a supportive role and not an active one (that is, the teacher should not do the work for the students). Students in a cooperative learning group can embark on an inquiry process as they work in a teacher guided activity.

ii. **Problem Solving Instructional Strategy**

Problem solving is an instructional strategy in which the teacher carefully designs and formulates problems which may be real or hypothetical(Bichi, 2006). Problem – solving model of instruction are based on the ideas of John Dewey (1938). He advocated acurriculum based on problem. He defined a problem as anything that gives rise to doubt and uncertainty. He maintained that for a problem to be an appropriate topic of study, it had to meet two rigorous criteria: It had to be important to the culture, and it had to be important and relevant to the student (Orlich et al, 2010).In one of his contribution, Dewey pointed out thatscientific principles and laws do not lie on the surface of nature. They are hidden, and must be uncovered from nature by an active and elaborate technique of inquiry. Olalekan and Jerome (2006), defined problem solving asa skill that requires finding a solution that is unique and novel to an identified problems and it is also the ability to adapt relevant technique from task on marginally related to the task at hand and to generate possible strategies to solve problems that are familiar. Problem solving involves the taking of series of actions in the process of an investigation that seeks to bridge the gap between a problem stated and the anticipated goal. Reporting of the same teaching approach, Awoyeye(2013) explained that a problem solving strategy comprises action steps taken by the learner to reach anticipated goal when faced with a problem

situation.According to Uchenna and Osokoya(2011) the learners are made to apply scientific knowledge to solve problem.The problem may be associated with the topic/subject and even real life problems. Learners should be encouraged to think critically, be creative in their approach and develop skills and techniques.Many researches support the use of this instructional strategy. Bichi(2002) described it as a gender friendly instructional strategy. In another separate study, Bichi(2006) reported that problem solving instructional strategy is more effective than the traditional teaching method.He further recommended that it should be incorporated into the main stream of pedagogy in science teaching in the 21 century.

However, a view that is accepted by many researchers of problem – solving is that problem solving skills can only be taught in a highly interactive process where students are left on their own to learn, preferably with the help of their peers (Mayer, 2004). Interaction with peers is a very important feature of cooperative learning – LittlewonderElis (2005) maintained that cooperative learning aids problem solving.Harskamp, Ding and Suhre(2000) also agreed that one of the ways to support students' problem solving processes is allowing the students to cooperate in shared task.

iii. **Computer- Assisted Instruction**

Computer – assisted Instruction (CAI) is also referred to as computer base education and Computer enriched instruction. It refers to virtually all kinds of computer use in educational settings, including drill and practice, tutorials, simulations instructional management, supplementary exercise, programming, data base development, writing using word processor and other applications (Bunkure, 2007). It

is the process by which written and visual information is presented in a logical sequence to a learner through a computer. He learns by reading the text material presented or by observing the graphic information displayed(Mahmood, 2012).Achuonye (2011) observed that with the introduction of computer into the educational system, it has been discovered that teaching could be developed into more flexible way through computer – assisted instruction (CAI) in order tomake it more responsive to student learning. It was submitted by Achuonye(2011), that the most important feature in computerization instruction is that it permits a high degree of individualization. He further explained that this is in effect means that student can proceed at their own pace, following a path through the curriculum as suited to their particular interest and talent. A debate exists as to whether or not CAI is effective means of improving student achievement (Tillman, 2004). She further reported that, study in the past focused on the relationship between CAI and achievement. However, Bunkure (2007) in his report, conclude that student academic achievement in physic is enhanced when computer is effectively utilized as a resource material. In his contribution, Yusuf and Afolabi (2010) found CAI mode of instruction effective for teaching Biology to secondary school students both in individualized and cooperative setting. Thisalso agreed with the report of Raninga(2010) which revealed the effectiveness of CAI mode of instruction over the traditional method of instruction in teaching mathematics among seven graders.Pandian (2004) investigated the effects of cooperative computer-assisted learning and traditional (teacher-centered) learning methods on students' learning achievement in biology. Results of the analysis of

covariance revealed that students in the cooperative computer-assisted group achieved better in Biology test than their colleagues in the traditional group.

Computer assisted learning strategy and cooperative learning teaching strategyare all nontraditional learning structures. This study however, is set to find out which of the group of student (field dependent or independent) will perform better under the cooperative instructional strategy.

2.3 Cooperative LearningInstructional Strategy

Cooperative learning is the instructional use of small groups so that students work together to maximize their own learning and each other's learning(Johnson, Johnson& Smith, 2013).Orlich et al (2010) sees co-operative learning as a learning based on a small-group approach to teaching that holds students accountable for both individual and group achievement. Akinbobola (2006) in his description sees cooperative learning as a mode of learning in which students of different levels of ability work together in small groups to achieve a purpose.It is a set of instructional strategies used to help learners meet specific learning and social integration objective in structured groups.

Dotson (2001) argues that, because human beings are social creatures by nature and cooperation has been used throughout history in all aspects of our lives, co-operative learning could be a logical teaching method. Obviously, students still learn by studying on their own, but some learn better in setting in which they can share ideas, ask questions and receive feedbacks (Orlich et al, 2010).Kolawole (2008) in his contribution opined that cooperative learning can cause a shift of emphasis from performance goals to learning goal. This is because the desired outcome often

emphasized in cooperative learning is more than the academic skills normally emphasized but include the acquisition of social skills that will equip the child to fit in well in various future work places. He also stressed thatin co-operative learning, cooperation rather than competition is emphasized.

Co-operative learning offers many benefits: For students, it improves both academic learning and social skills for teachers; it is an aid to classroom management and instruction (Cohen,Brody& Sapon-Shevin 2004). Mueller and Fleming (2001), Roman (2007) all posited that, co-operative learning enhances students' enthusiasm for learning and their determination to achieve academic success.A number of empirical evidences support the use of co-operative learning strategies with variety of subject areas and age groups within and outside Nigeria (Jumoke and Idowu, 2013).It has been shown to improve the relationship among diverse students from different cultures (Allison and Relim, 2007, Hallego and Cole, 2001).

As a matter of fact, another reason for cooperative learning to be successful in the classroom was because it maximizes the learners learning, which would be better explained through the learning pyramid (fig. 2).

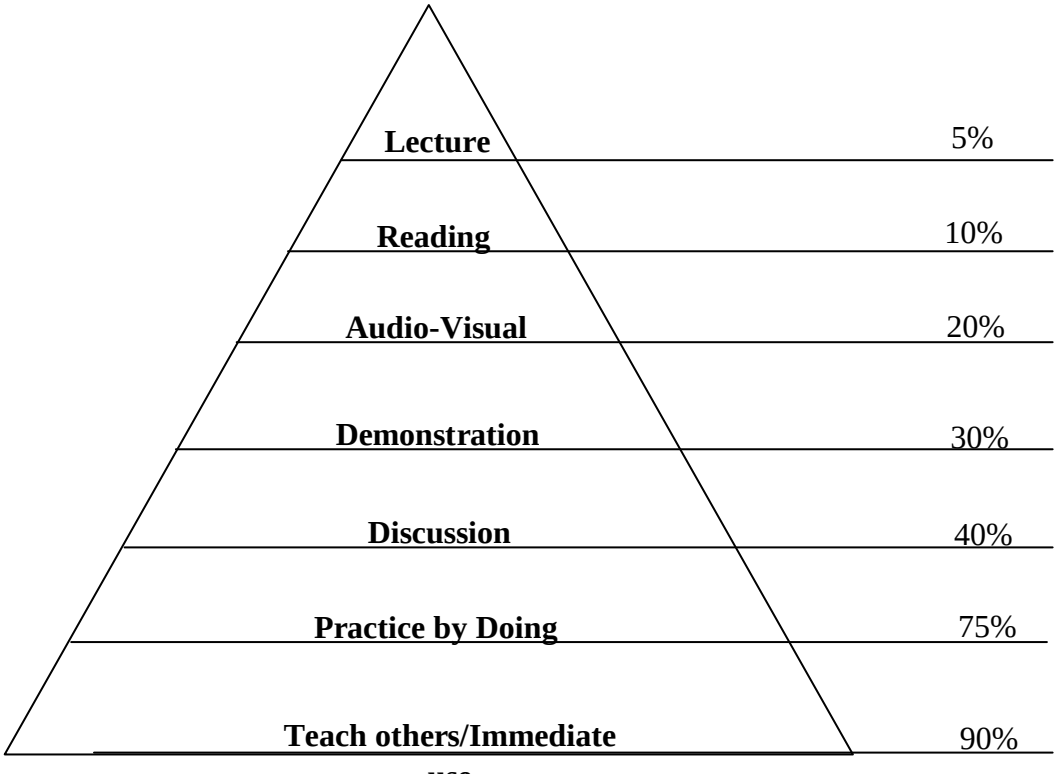


Figure 2.1 Learning Pyramid(Adapted from Liang,2002)

The pyramid was the result of a research undertaken by Professor Tim Brighouse at the University of Keele, England. It quantified retention in relation to the teaching method. There is a strong correlation between the ways we learned and the retention of the material learned (as illustrated above). Liang(2002) commenting on the pyramid says that, as one move down the pyramid there is a gradual shift from passive observation of the learner to active participation and a corresponding increase in retention. According to the pyramid, retention rates were the highest with teamwork which include(a) discussion group: 40% (b) practice by doing: 75% and (c) teaching others/ immediate use of learning : 90%.The part of the pyramid (Discussion group)

corresponds to cooperative learning experience. Cooperative learning encourages teaching of science to others. Liang (2002) explained that the higher the involvement in the learning process, the higher the retention of the material learned. The implication is that teachers should coordinate and facilitate, but the student should by all means do the work themselves – an opportunity offered by cooperative learning instructional strategy. In cooperative learning teaching strategy students are actively engaged with task material and with each other. Liang (2002) earlier reported that the rate of engagement is proportional to the rate of retention. As students engage in discussion and explanation of concept in a cooperative learning setting, it eventually leads to cognitive re-structuring which makes student modified their views leading to better understanding and retention (Opara, 2013). Olarewaju (2012) also supported this claim when she concluded that the use of cooperative learning instructional strategy enhanced the retention of biology concept.

2.3.1 Features of Cooperative Learning

These features according to researchers often distinguish cooperative learning from other forms of grouplearning. These elements are the ingredients necessary to ensure that when students work in groups, they work cooperatively. Not all groups are cooperative (Johnson & F. Johnson, 2009). A learning exercise only qualifies as cooperative learning to the extent that certain elements are present. Researchers like Ballantine &Larres(2007) posited that, cooperative learning has five distinct features.

- Positive Interdependence
- Face- to – Face Interaction

- Individual Accountability
- Development of Social Skills
- Group Evaluation

i. Positive Interdependence

Positive interdependence is a management system that encourages students to work together with the assumption that the success of each student enhances the quality of learning for all students (Orlich et al., 2010). Students must believe that they are linked with others in a way that one cannot succeed unless the other members of the group succeed (and vice versa). Students are working together to get the job done. In other words, students must perceive that they sink or swim together. In fact, if there is no positive interdependence, there is no cooperation. Once positive interdependence is incorporated, competition among team members is removed – as members work together to ensure the success of each group member.Johnson, Johnson& Smith (1998) outlined the following ways in which positive interdependence can be incorporated in to group learning:

- Goal interdependence – The group has a common goal and every member of the team is expected to achieve it
- Incentive Interdependence- Everyone receives the same reward but only if every member of the team succeeds
- Resources Interdependence- Resources, information, and material are limited so that students are obliged to work together and cooperate in sharing available resources.

- Sequence Interdependence – The overall task is divided into sequence of subtasks. Individual group members perform their particular task as part of a predetermined order
- Role Interdependence – Each group members is assigned a role with specific responsibilities. Each role contributes to and supports the tasks completion.
- Identity Interdependency-The group establishes a mutual identity through a name, flag, logo or symbol. These can be augmented by a group song or cheer.
- Outside force Interdependence –The group as a whole competes against other groups.
- Simulation interdependence – The group members imagine that they in a role or situation where they must collaborate to be successful.
- Environmental Interdependence – The group member work together within a specified physical space, such as section of the classroom.

In positive interdependence, every group member does help his/her team mate to understand a concept better. According to the learning pyramid, retention rate increases with the amount of student involvement. The rate of retention were the highest with teaching others = 90%(Liang,2002). This shows that, teaching/helping one another will benefit both the individual and the group as a whole. Students work until each group member successfully understands and completes the assignment, thus creating an atmosphere of achievement. As a result, they frame new concepts by basing their conclusions on prior knowledge. This process results in a deeper understanding of the material and more potential to retain the material (Palmer,Peter, &Streetman, 2003).

ii. Face – to – Interaction

In cooperative learning situations, students interact, assist one another with learning tasks, and promote one another's success. The small group setting allows students to work directly with one another to share opinions and ideas, to come to common understandings, and to work as a team to ensure each members success and acceptance. According to Green (2013), there are important cognitive activities and interpersonal dynamics that can only occur when students promote each other learning. This includes orally explaining how to solve problem, teaching one's knowledge to others, checking for understanding, discussing concepts being learned and connecting present with past learning. She concluded that it was through promoting each other's learning face to face that members become personally committed to each other as well as to their mutual goals. This allows for continuity of interaction among group members and creates the opportunity for social cohesion and bonding to develop among group members.

According to Vygotsky (1978), such interaction plays an important role in the development of cognition and also it is key to the process of making meaning. It follows that, as student interact with one another in a promotive interaction, important learning takes place. In a cooperative dialogue like this, where a more knowledgeable individual engages a less knowledgeable one, his/her understanding of that concept becomes better (Mcleod, 2007).

In relation to this study, field independent student that naturally like working in isolation will find themselves in a face to face interaction and also positive inter dependency – which will, undoubtedly,bring better understanding of the group task.

iii.Individual Accountability

Individual accountability means that the team's success depends on the individual learning of all team members**.**According to Johnson(2009),it means that students ask for assistance, do their best work, present their ideas, learn as much as possible, take their task seriously, help the group to operate well and take care of one another.Individual accountability is a very important element that needs to be structured into cooperative learning lessons. It gives each member of the group a sense of personal responsibility toward goal achievement (Johnson&Johnson, 2009). Johnson et al (1998) suggested that the teacher can structure and increase individual accountability by,

- by giving individual test to each students, or
- by checking for understanding through random oral individual examination
- by observing each group and group member
- by Keeping track of student contribution to group work.

The above measures also discouragemembers from riding on others back to just earn group grade.

iv. Development of Social Skills

Social skills are skills that enables one to recognize and manage his/her emotions, develops caring and concern for others, establish positive relationships, make responsible decisions, and handle challenging situations constructively and ethically (Zins, Weissbert, Wang, & Walberg, 2004)**.**Killen(2007) in his contribution maintained that,social and interpersonal skills, such as listening attentively,questioning cooperatively and negotiating respectfully need to be taught to help students cooperate

effectively in the group. Social skills for cooperative work do not just appear magically when cooperative lessons are employed. These skills must be taught by the teacher to the student just as purposefully and precisely as academic skills. In fact, earlier, Wolford, Heward &Alber(2001) posited that as a teacher you need to actively teach social skills on a daily basis, ask students to practise those skills on daily basis, ask students to practice those skills within their cooperative groups, and have students provide feedbacks on group interactions and social processes.

v. Group Evaluation

According to Orlich et al (2010), Group of students need to evaluate and discuss how well they are meeting their goals, and what actions help their group, and what action seem to be hurting group interactions. They may articulate these evaluations during class discussion or provide the teacher with written progress reports. Students should also have a way of alerting the teacher to group problems. They suggested that a teacher should develop plans for engaging students in problem solving and conflict resolution. Group processing helps improve the effectiveness of the members in contributing to the shared efforts to achieve the group goals via reflection on the learning process(Yamarik,2007).In summary, the features discussed above distinguished cooperative learning teaching with other group learning.

2.3.2 Models of Cooperative Learning Instructional Strategy

Cooperative Learning Models are quite enormous. However, the following models enjoyed wider publication. They include:

- Student Team Achievement Division (STAD)
- The JIG-SAW Model

- Learning Together Model
- Team Game Tournament(TGT)
- Cooperative Integrated Reading and Composition(CIRC)
- Team Assisted Individualization(TAI)
- Group Investigation(GI)

Student Team Achievement Division (STAD)

The Student Team Achievement Division (Slavin, Student Team Division (STAD), was originated by Robert Slavin and his colleagues at John Hopkin University. The STAD model underscores many of the attributes direct instruction and it is a very easy model to implement in the science classroom, STAD operates on the principle that student work together to learn and are responsible for their teammates learning as well as their own. The STAD according to Slavin (1994), has four phases: class presentation, team study, test and team recognition

Phase I: Class Presentation

The class presentation is a teacher-directed presentation of the material concepts, skills, and processes that the students are to learn. The presentation can be a lecture, lecture/demonstration, or audiovisual presentation. You also could follow the lesson plans in your science textbook, including the laboratory activities in this phase of STAD. Several lessons would be devoted to class presentations carefully written and planned objectives should be stated and used to determine the nature of the class presentation, and the team study to follow. Here at this stage, the teacher can for instance,

- Define genetics as a science of inheritance

- Define inheritance as the transmission of character from parent to offspring
- Transmittable and non-transmittable character can be discussed.

Phase II: Team Study

In STAD teams are composed of four students who represent a balance in terms of academic ability, gender, and ethnicity. The team is the most important feature of STAD, and it is important for the teacher to take the lead in identifying the members of each team. Slavin (1990) recommends rank ordering your students in terms of performance. Each team would be composed of high ability student and low ability student. The goal is to attempt to achieve parity among the teams in the class. Teams should also be formed with sex and ethnicity in mind. Each team should be more or less an average composite of the class.

Team study consists of one or two periods in which each team masters material that the teacher provides. The teacher'sroles here include:

- Provision of material for each group to study.
- Provision of worksheet for group members to work with.
- Givingeach team two worksheets and two answer sheets (not one for each student);and
- Encourages the group to make sure each member can answer all questions on the worksheet.

Post the following team rules on the bulletin board:

1. Students have the responsibility to make sure that their teammates have learned the material.

2. Students must ensure that all team mates have mastered the subject.
3. Ask all teammates for help before meeting the teacher.
4. Teammates may talk to each other softly.

It is important for the teacher at this stage, to encourage team members to work together. A principle that is integral, not only to STAD, but to all cooperative learning models is that students must talk with each other in team learning sessions.

It is during these small group sessions that the teacher encourages students

- To teach each otherand learn from each other,
- Explain to each other their answers to the questions; this encourage deeper understanding.

The teacher moves from group to group, asking questions and encouraging students to explain their answers.

Phase III: Test

After the team study is completed, the teacher administers a test to measure the knowledge that students have gained. Students take the individual tests and are not permitted to help each other.

Phase IV: Team Recognition

Team recognition is based on the student base score and his contribution to the group scores. According to Liang (2002), the student base score can be derived from their previous term examination grade. For instance, a student scored 30 in the first quiz, his base score will now be 30. The student improvement point will now depend on his score in the next test. For example, if he scores 36 in the next test then the contribution points he now earned for his group will be 5point because he scored more

than 5 points above his own base score. However, if he scored 55 in the next test (i.e, more than 20points above the base score), his improvement points will be 20 points. The conversion table below sheds more light.

Table 2.2: Conversion Table of Improvement Points

Individual Gain	Group Gain
1. More than 5 points above base score	5 improvement points
2. More than 10 points above base score	10 improvement points
3. More than 15 points above base score	15 improvement points
4. More than 20 points above base score	20 improvement points
5. More than 30 points above base score	25 improvement points

(Adapted from Slavin, 1995)

The group score would be the total of each member contribution points rather than the raw quiz scores. Thus a relatively low achiever could contribute as much to their team as much as a high achiever without doing as well in the test. How well one did on the test would affect group scores. Therefore they have to study hard for themselves as well as for their group members. These low achievers are not jealous of their team mate high scores as they might in a traditional classroom. Instead they began to hope that all of their group members could get more and more scores- this therefore enhances the *spirit de corps*.

Teachers can use special words to describe the teams' performance such as science stars, science geniuses, or Einstein. Recognition of the work of each team can occur by means of a newsletter, handout, or bulletin board that reports the ranking of each team within the class.

Jigsaw Model (Aronso, 1971)

Jigsaw cooperative learning model was invented by Elliot Aronso in 1971.The idea was that cooperation will develop each individual, and each individual can reach a goal only if all other individuals reach their goals(Aronso, 1978). In the Jigsaw model the student becomes a member of both a learning group (Jigsaw group) and a research team (Expert group).The Jigsaw or learning group is the cooperative learning study group formed by the teacher. It can be homogeneous or heterogeneous group of 4-6 members. A Jigsaw group can be represented as ABCD.After determining the learning group's goal, the members meet other group members assigned the same topic to form an expert group. Thus, an expert group can be represented as AAAAA, BBBBB, CCCCC e t c. In other word, an expert group is a group of members drawn from different learning group to study and become expert on a particular segment of the learning material. Research teams or expert group meet together to learn about a particular piece of the learning puzzle (topic). That is each member returns to his learning group as an expert on a particular segment of the learning material. Each member is dependent on the others for success in learning all the material. Each member is accountable for teaching his or her material to the other group members and learning the material they are teaching. Aronso (2000) suggested ten steps to implementing Jigsaw technique in our classroom. These include:

- The teacher group student into four to six in a Jigsaw groups. The groups can be either homogeneous or heterogeneous in nature.
- The teacher appoints one student from each group as leader. Initially this person should be most mature student in the group.

- The teacher divides the concept to be learned into five – six segments (puzzle). For instance in genetics, concept like gene can be divided/segmented into: chemical composition, structure, position in the cell, role in heredity e. t. c.
- The teacher assigns each student in a group to learn one segment at least twice and become familiar with it. There is no need for them to memorize it.
- The teacher now forms temporary expert groups by having one student from each Jigsaw group join other students assigned the same segment. For instance, a member (A) of a group assigned the topic, chemical composition of gene to study should meet other members of different Jigsaw group assigned the same topic to now form an expert group. So that an expert group with members drawn from four Jigsaw group would be AAAA- in other word, all the four members were assigned the same segment of the topic gene to learn.
- The teacher should give the students in this expert group time to learn, rehearse the material they intend to present to their groups.
- The teacher now brings the student back from their expert group to their jigsaw groups.
- The teacher asks each student to present/report her or his segment to the group. The teacher encourages others in the group to, listen, ask question for clarification.
- The teacher move from one group to another observing the process. If any group is having trouble (for example, a member dominating or disruptive). She/he makes make appropriate intervention.

- At the end of the session, the teacher gives a test on the material so that students quickly come to realize that these sessions are not just fun and games but really count.

Aronso (2000) explained that the situation in a Jigsaw class room is specially structured so that the only access any member has to the other assignments is by listening closely to the report of the person explaining or teaching. He further maintained that, to increase the chances that each report is accurate; the students doing the research do not immediately take it back to their Jigsaw group. Instead, they meet first with expert on the same topic from other group to have better understanding on the topic. He further posited that the benefits here are: it is a remarkable way to learn the material; it encourages listening, engagement and empathy by giving each member in a group an essential role to play in the academic activity. Group members must work together as a team to accomplish a common goal – each person depends on all the others. This cooperation by design facilitates interaction among all students in the class leading them to value each other as contributors to their common task.

A key distinguishing features between the STAD and the jigsaw model is that,

- The jigsaw model emphasizes the formation of the jigsaw/learning group and the expert / research group. While in the STAD model only learning group is formed.
- The STAD scoring method, emphasizing the individual base Score and its contribution to group score also distinguishes the STAD from the other model. However, Lam(2005) reported that STAD scoring system can also be employed in a Jigsaw model.

Learning Together Model Johnson and Johnson Model (1975)

Learning together model was developed and advocated by David and Roger Johnson. According to Olurookoba (2001), this model simply used classroom groups of four or five members. Group work on a common assignment, and submitted a group report of their results. Classroom evaluation is based on the group-work; no individuals are identified.

Team Game Tournament (DeVries and Slavin, 1978)

Teams-Games-Tournament (TGT) is one of the team learning strategies designed by RobertSlavin for review and mastery learning of material. Slavin has found that TGT increased basic skills, students' achievement, positive interactions between students, acceptance of classmates and self-esteem.

Team Game Tournament (TGT) is one of the effective evaluating procedures of Cooperative Learning. The TGT structure encourages competition and cooperation in a way that promotes peer group rewards for academic achievement. The TGT model has two teams, they are:

- Study Team or Home Team
- Tournament Team

The study team is a heterogeneous team of four students. The heterogeneity is based on academic ability. The studentsreview and study the material cooperatively in these teams. The tournament team however, is homogeneous team of either low ability or high ability(Mahony,2006). According to Gaikwad (2011), the teacher prepares the following items:

1) A list of teams, generally made of four members, each from a different home group (post two three copies of the list in the room).

2) A set of question and answer sheets for each team.

3) A set of number cards (numbers corresponding to the number of questions) for each team and a score sheet for each team.

The TGT procedure, according to Gaikward(2011) is as follows:

1. Looking at the team list, members form teams and sit together.
2. A material-manager from each team picks up the materials for the team.
3. Write the names of team members and home group names on the score sheets.
4. Decide on the direction of the game, clockwise or anticlockwise.
5. Number cards are shuffled and members pick up cards. The one with thehighest number is to begin the game.
6. Number cards are put back and shuffled again.
7. The first person begins the game by picking a card. He/she reads the correspond question from the question paper.
8. He/she will answer the question while others listen. If correct, the person gets to keep the card. If wrong, any member may challenge and answer it, then that person gets to keep the cards. If nobody knows the answer, the answer sheet is checked for the right answer. Then must verify the answer from the answer sheet, just to be sure.
9. The game will go on in this manner, with one person getting one turn at a time.
10. The game is more fun when it is crisp and fast.

11. When all the cards are won, points are counted (may count two points for each card) and written in the score sheet under round 1.
12. If time remains, subsequent round may be played
13. When an allotted time is complete (30 minutes or so), the teacher stops the game. Material managers bring the tabulated score sheets (along with the rest of the materials) to the teacher.
14. The teacher writes the scores on the board for each home group and totals the score.
15. The team with high score are adjudged the winner

Cooperative Integrated Reading and Composition (CIRC)

This is a comprehensive program for teaching reading and writing in the upper elementary grades is called Cooperative Integrated Reading and Composition (CIRC) (Stevens et al. 1987). In CIRC, teachers use reading texts and reading groups, much as in traditional reading programs. However, all students are assigned to teams composed of two pairs from two different reading groups. While the teacher is working with one reading group, the paired students in the other groups are working on a series of cognitively engaging activities, including reading to one another, making predictions about how narrative stories will come out, summarizing stories to one another, writing responses to stores, and practicing spelling, decoding, and vocabulary. Students work as a total team to master main idea and other comprehension skills. During language arts periods, students engage in writing drafts, revising and editing one another's work, and preparing for publications of team books. In most CIRC activities, students follow a sequence of teacher instruction, team practice, team pre-assessments and

quizzes. That is, students do not take the quiz until their teammates have determined that they are ready. Certificates are given to teams based on the average performance of all team members on all reading and writing activities(Slavin, 1995). According to Slavin& Madden (2009), CIRC has been adapted as the upper-elementary and middle school component of the Success for All Comprehensive reform model and is currently disseminated under the name,"Reading Wingsby the Success for All Foundation".

Team Assisted Individualization (TAI:Slavin et al.1986)

Team Assisted Individualization (TAI) shares with STAD and TGT the use of four-member mixed ability learning teams and certificates for high-performing teams. However, where STAD and TGT use a single pace of instruction for the class, TAI combines cooperative learning with individualised instruction (Slavin, 1995). Also, where STAD and TGT apply to most subjects at grade levels, TAI is specifically designed to teach mathematics to students in grades 3-6 (or older students not ready for a full algebra course).

In TAI, students enter an individualized sequence according to a math placement test and then proceed at their own learning rates. In general, team members work on different units. Teammates check each other'swork against answer sheets and help one another with any problems. Final unit tests are taken without teammate help and are scored by student monitors. Each week, teachers total the number of units completed by all team members and give certificates or other team rewards to teams that exceed a criterion score based on the number of final tests passed, with extra points for perfect papers and completed homework.

Because students take responsibility for checking each other's work and managing the flow of materials, the teacher can spend most of the class time presenting lessons to small groups of students drawn from the various teams who are working at the same point in the mathematics sequence. For example, the teacher might call up a decimals group, present a lesson, and then send the students back to their teams to work on problems. Then the teacher might call the fractions group, and so on. Several large evaluations of TAI have shown positive effects on math achievement in the upper-elementary grades

Group Investigation.(Sharan& Sharan,1992)

Group Investigation (GI) was developed by ShlomoSharan and Yael Sharan (1992) at the University of Tel-Aviv. It is a general classroom organization plan in which 19 students work in small groups using cooperative inquiry, group discussion, and cooperative planning and projects(Slavin,1995). In this method, students form their own two- to six-member groups. After choosing subtopics from a unit being studied by the entire class, the groups further break their subtopics into individual tasks and carry out the activities necessary to prepare group reports. Each group then makes a presentation or display to communicate its findings to the entire class. Sharan&Shachar (1988) found positive effects of Group Investigation on achievement in language and literature.

Majority of the cooperative models mentioned above advocate for heterogeneous pattern of grouping. The argument is that the classroom has students of varying ability, cultural background, ethnicity etc. and that a heterogeneous group is a representation of theclassroom. However, in this present study, the studentwere

grouped homogeneously and heterogeneously according to their cognitive style. For instance, from the characteristics of field dependent and independent students, It can be deduce that, their attitude and most likely their achievement might not be the same.

2.3.3 Homogenous and Heterogeneous Grouping

Homogenous grouping entails grouping students with the same characteristics (i.e, gender, academic ability, cognitive style etc.). Heterogeneous grouping on the other hand entails grouping of students with varying characteristics like gender, academic ability, and cognitive style etc. Types of group are an important consideration in creating cooperative learning group. They enumerated homogenous and heterogeneous grouping as types of grouping pattern in cooperative learning strategy. Palmer et al.(20003), also supported that the group can be homogenous or heterogeneous. Marzano, Pickering, and Pollock, in their argument, explain that there are advantages to both methods of grouping depending on what the teacher wants to do. Johnson (2011) opined that if given a choice, students prefer to learning in homogeneous groups, but they also appreciate getting to know and learn from other members of the classroom.

However, researches in cooperative learning often emphasize on heterogeneous grouping, perhaps due to the strong assumption about the importance of heterogeneous groups to promote social interaction and also to maximize heterogeneity of skills and abilities. The use of homogeneous grouping has therefore been rather unusual. In his argument, Baer (1999) maintained that even though all of its adherents have consistently emphasized the importance of heterogeneous grouping in cooperative learning, there is little evidence of its effectiveness in comparison with

homogeneous grouping. The heterogeneity underpinning cooperative learning did not originally include the linguistic, cultural diversity, cognitive style and learning style variation which is now the rule rather than the exception in many schools. However, in structuring cooperative learning group careful forethought should be given to the question of who comprises each learning group in an attempt to create the optimal social learning environment.

The homogeneity and heterogeneity emphasized in cooperative learning researches has to do with academic ability. However, it is an established fact that cognitive style and academic ability are not the same. Cognitive style is simply the student preferred way of processing, attending and solving of problem or going about task. This study therefore will emphasize on the homogeneity of the groups in term of cognitive style (either field dependent or independent cognitive style). It is hypothesized here that since both category of cognitive style have strength that can encourage learning in a cooperative learning setting, having them study in a homogenous group could lead to more positive attitude and better achievement. In other word, students of similar cognitive style might tend to see things the same way therefore might not encounter much cognitive dissonance as they interact.

Another argument that support this study is that students learn best when they are taught in ways that match their way of learning style (Lovelace, 2005; Mahlios, 2001; Ogden, 2003; Stanberry & Azria, 2001). Some studies result supported the fact that field independent (FI) learners will be better taught by field independent teachers, while field dependent learner (FD) will be better taught by FD teachers. For instance Garlinger and Frank 1986 (in Fan and He, 2012) argued that FI students showed

greater achievement when matched with FI teachers. Saracho (2001) study also provided evidence for this view. He reported that FI preferred FI teachers while FD student's preferred FD teachers. One would expect FD students to do better under a teaching strategy that encourages interaction between students, such as cooperative group instruction (Tinajero, Castelo, Guisande and Paramo, 2011).In fact, FD openly express their preference for this type of methods (Sadler- Smith, 1999). However, there is not enough data to confirm the expected mediation of cognitive style on the effectiveness of an interactive group dynamics.

The research reports above support that FI or FD learners in a homogenous group will be more comfortable with their group members and likely to perform better. Since in cooperative learning teaching strategy, students teach each other with the teacher taking the role of a facilitator- one could rightly deduce that a homogenous grouping of field dependent (FD) and a homogenous grouping of field independent(FI) student taught under a cooperative learning teaching will show a positive attitude to learning and also have a higher achievement scores. For cooperative learning teaching strategy will not only promote academics gains in both field independent (FI) and field dependent (FD) but also will help to modify the attitude and fill in the social gap in field independent students. What will be the attitude of matching FI students with other FI students in a cooperative learning teaching group? Will a homogenous group of FD students perform better or show more positive attitude? Therefore, this study seeks to find the effect of cooperative learning strategy on the attitude and performance of field dependent and independent student in both heterogeneous and homogenous groups.

2.4 Cooperative Learning Instructional Strategy, Cognitive style and Attitude

Attitude is a hypothetical construct that represents an individual's like or dislike. Attitude is individual reaction, feelings and impression about a subject and the subject related tasks or situation (Ezema, 2002). Attitude has three major components;

- Cognitive,
- Affective and
- Behavioral oroperational.

The cognitive component provides knowledge about the object, subject or the other person. The source of knowledge could be direct or indirect. As students interact with instructional material and with one another they tend to acquire cognition. The acquisition of cognition due to cognitive restructuring leadsto the affective component.(Muhkhajee,2000). In other word, interaction with the instructional material and with one another leads to cognitive restructuring which might affect the way one sees things and thereby leading to a change in attitude. For what you know about an object, subject or situation determines how you feel about it. This determines the feelings, either that of like or dislike.

The operational component includes a predisposition (a kind of readiness) to react favorably or otherwise. Thus, an attitude is a function of antecedent stimulus conditions and, in turn, as determinant of observable behavior that follows.

Several research have pointed to the fact that instructional strategy has influence on students attitude as it determine to a great extend how positive or negative the classroom climate will be (Shukla, 2005; Starr, 2004). Lord (2001) earlier submitted that, biology students who were provided in-class opportunities to

interact actively with classmates and instructors were happier, enjoyed biology more, and were more satisfied with their learning experiences than were students who were taught exclusively by lecture. It therefore follows that a good instructional strategy will lead to cognitive restructuring which result in meaningful understanding of a concept which will eventually lead to a more positive attitude. In other word, a friendly and interactive climate generated by cooperative learning can evoke positive attitude.

Ajaja and Eravwoke (2010) showed that students in the cooperative learning classroom were found to exhibit positive attitude towards the learning of science, as measured by their attitude scores, using an attitude scale They further explained that this seems to agree with the general notion that individuals can change their attitude and disposition through interaction with others in one way or the other.

Dyel (2011), in a study, reported that, more positive attitude was shown by the students after exposure to cooperative learning teaching strategy.Lai (2002) found that, students taught using cooperative learning were motivated to study English harder and participated more in class by asking and responding to questions.

In a related but separate study, Barchok, Too and Ngeno (2013) investigated the effect of collaborative concept mapping (CCM) strategy on the students attitudes towards chemistry (ATC) in selected secondary schools in Kenya. The result however, upheld the null hypothesis that, there was no significant difference in the attitude of students toward chemistry (ATC) between students exposed to CCM teaching strategy and those exposed to conventional method of teaching. They concluded that Chemistry as subject in the curriculum does not appear to be a disliked subject. The

researcher also concluded according to the result obtained that, student perception of Chemistry as a science in the curriculum has changed for the better.

According to Ajaja and Eravwoke (2010), attitude of learners are formed through social interaction. In fact they insisted that cooperative learning helps learners acquire from the curriculum some basic cooperative attitudes. In a cooperative learning environment, attitudes are formed by discussing what we know or think with others. This exchange of ideas has a way of causing a cognitive restructuring leading to a better or positive attitude (Borich, 2004).

In a cooperative learning setting, field dependent student will be in group teaching and sharing idea with one another – it is expected that they will show more positive attitude to this form of learning as it agrees with their social inclination. Blanton (2004) described FD learners as those inclined to social activity. It is also assumed that field independent (FI) learners will also likely show a positive attitude towards cooperative learning for they will be more at home with little or no teacher interference. Additionally, since cooperative learning instructional strategy is structured in such a way that the FI students learn by interaction with team members in a heterogeneous group for instance, It is reasonable to suggest that, interaction between the FI and FD students might lead to a kind of rethink which would eventually lead to a change in their preferences. Interaction among them can also help reduce the dissonance induced by group disagreement through a variety of interpersonal strategies to achieve consensus. This study therefore is set to find out the effect of cooperative learning instructional strategy on the attitude and achievement of

field dependent and independent students as learn in a homogeneous and heterogeneous cooperative learning group.

2.5 Cooperative Learning Instructional Strategy and Student Performance

Performance is the holistic or integrated demonstrations of mental, affective and manual activities. Performances also express particular values. Demonstrations of performance for assessment also require completion of specific tasks that are observable and measurable (Mothata, 2000). According Ksheerasager and Kavyakishore(2013),it is the extent to which a student grasps the subject matter of science.The teacher method of teaching is central in the implementation of any planned curriculum and for science education to meet the world standard, science teachers must carefully employ teaching strategies that are child centred. Many researchers report a link between instructional strategy and student academic performance. Bichi (2002) reported that, subject taught with problem solving teaching method performed significantly better than those taught under traditional teaching method. He concluded that instructional strategies employed by a teacher have significant effects on student's performance. Okoronko and Wada (2014) found the use of Instructional Strategy significantly effective on academic achievement in Physics

Ren-shing's (2006), found that students in Jigsaw cooperative learning group perform better than students who were taught using the conventional lecture method. This was supported by Seng (2006) who concluded that a cooperative learning experience promotes higher achievement than individual learning. In his own

contribution, Kolawole (2008) concluded that cooperative learning instructional strategy affect the student's achievement positively.

From the above reports one could see that, cooperative learning instructional strategy affect the performance of students positively. This can be attributed to the fact that cooperative learning instructional strategy is student centered pedagogy. Student centered pedagogy often lead to better retention, better problem solving, better application of knowledge and also better motivations (Olarewaju, 2012, Erinosho,2008)

However, many researchers have reported that individuals of different ability or cognitive style might achieve differently under different instructional strategy. For instance, research has shown that, field independent learners achieve higher than their counterparts, field dependent learners under the traditional instructional setting. cooperative learning instructional strategy assists the field dependent individual to learn better. This goes to say that, the performance of field dependent and field independent might not likely be the same under cooperative learning instructional strategy. However, the question here is who among the two categories of learners would perform better under cooperative learning structure. Field independent students are able to see isolated part of the problem, they are described as reflective and also analytical in the way they approach problem. Therefore it seems reasonable for one to expect the FI students in a homogenous cooperative learning environment to have less cognitive challenge, to critically study the material and score high Performance score than a homogenous group of FD student under the same treatment. Could cooperative learning instructional strategy provide an effective environment for the contribution of

FD and FI styles to academic performance? This study will attempt to look at the effect of cooperative learning teaching strategy on the Performance and attitude of student of different cognitive styles.

2.6 Cooperative Learning, Cognitive Style and Self Efficacy

Self-efficacy is defined as an individual's perceived level of competence or the degree to which she or he feels capable of completing a task. Self-efficacy is a dynamic trait that Changes over time and can be influenced by experiences. Self-efficacy expectations are considered the primary cognitive determinant of whether or not an individual will attempt a given behavior (Reisberg, Raelin, Bailey, 2012). Self-efficacy belief is very essential in guiding learner's personnel and academic accomplishments (Mari & Gumel, 2015) According to Bandura(1986), people possess a "self-system" that enables them to exercise control over their thoughts, feelings, and actions. This self-system is comprised of cognitive and affective components including the ability to symbolize, learn from others, plan alternative strategies, regulate one's own behavior, and engage in self-reflection. Bandura (1986) identified four sources of information that shape self-efficacy: (1) performance accomplishments, (2) vicarious experience, (3) verbal persuasion, and (4) physiological and affective states.

Performance experience leads to two possible outcomes that influence self-efficacy: the perception of success or the perception of failure. An outcome perceived by a student to be a success brings about a greater sense of self-efficacy. The outcome believed to be a failure lowers it.

Vicarious experience, or the observing of others performing a task, is the second type of experience affecting self-efficacy beliefs. According to Bandura (1986), Verbal persuasions or verbal judgments are comments by significant others that develop beliefs in self-efficacy (Bandura, 1986; Alderman, 1999). Bandura believed that verbal persuasion can contribute to successful performance if the heightened appraisal is within realistic bounds. Negative comments are more effective in lowering self-efficacy than positive comments are in increasing self-efficacy (Alderman, 1999). A learner's physiological state cans also affect self-efficacy; for example, anxiety, fear, fatigue, or pain can all affect self-efficacy beliefs (Bandura, 1997).

Cooperative learning can help to provide the above mentioned experiences needed for the development of stronger self-efficacy. In a cooperative learning setting, success or failure is often shared by all group members. Many times, students express relief when they know they are not the only ones who are having difficulty with a given skill or concept (Schulze & Schulze, 2003). They posited that allowing students to study in group can help to nurture students sense of self efficacy and will also give an opportunity for student with stronger self-efficacy to serve as a coping model to those with lower self-efficacy. It is also worthy of mention, that in a cooperative learning group, a student helped by a more knowledgeable one can perform better in a test and this proffer her/him the performance experience needed for a high self-efficacy.

According to Sankar& Raju (2011), two main factors that determine academic success are cognitive styles and self-efficacy. It is vital the teachers understand how to

incorporate student cognitive styles in the classroom in order to create a positive learning environment (Graham, 2015).According to Abeer (2004), the interaction between learning styles and self-efficacy has a strong positive impact on the academic performance. He reported that, the converging learning style candidates' with high self-efficacy proved to be the best academic performer among other learning styles. Many researchers have tried to establish a relationship between self-efficacy and student learning style (i.e, Abeer, 2004, Boldaji,2008, Shahsavar & Hoon, 2011).

In connection to this study, it can be argued that the FI students might serve as a coping model to the FD students in a heterogeneous group. For instance Shahsavar & Hoon, (2011), reported that the fields independent have high self-efficacy than the field dependent students.

2.7 Style Construct

There is evidence that the way individuals habitually approach different tasks, situation and events- that is style – has an impact on processes such as decision making, problem solving, perception, and learning (Cools, 2009) and ultimately influences behavior and outcomes. Attempts to conceptualize these habitual approaches have led to the emergence of concepts and constructs such as:

(a) Learning style (Kolb, 1976)

The concept of learning style originated with Riessman (1962). However, Keefe (cited, in Umar2011) defined learning style as characteristic cognitive, affective and psychological behaviors that serve as a relatively stable indicator of how a learner perceive, interact with and respond to the learning environment. Learning style explains the interaction of learning environment with the cognitive or personality

characteristics of learners. According to Peterson, Rayner, and Armstrong (2009), learning styles focus is more on how one comprehends and responds to the information from a more global perspective. They describedLearning styles as environmentally dependent variable that seems to have broader effects on learning behavior and not just on cognitive processing.

The only conceptualization of learning style standing out today with substantial articles is the Kolb (1984). Kolb (1984), describes learning styles in four dimension: converger, diverger, assimilator, and accommodator. The four learning style dimensions are explained briefly below:

- Converging Learning Style

People with this learning style are best at finding practical uses for ideas and theories. They have the ability to solve problems and make decisions based on finding solutions to questions or problems. Individuals with a Converging learning style prefer to deal with technical tasks and problems rather than with social issues and interpersonal issues. These learning skills are important for effectiveness in specialist and technology careers. In formal learning situations, people with this style prefer to experiment with new ideas, simulations, laboratory assignments, and practical applications.

- Diverging Learning Style

People with this learning style are best at viewing concrete situations from many different points of view. It is labeled diverging because a person with it performs better in situations that call for generation of ideas, such as a brainstorming session. People with a diverging learning style have broad cultural interests and like to

gather information. They are interested in people, tend to be imaginative and emotional, have broad cultural interests, and tend to specialize in the arts. In formal learning situations, people with the diverging style prefer to work in groups, listening with an open mind to different points of view and receiving personalized feedback.

- Assimilating Learning Style

People with this learning style are best at understanding a wide range of information and putting it into concise, logical form. Individuals with an assimilating style are less focused on people and more interested in ideas and abstract concepts. Generally, people with this style find it more important that a theory have logical soundness than practical value. The assimilating learning style is important for effectiveness in information and science careers. In formal learning situations, people with this style prefer readings, lectures, exploring analytical models, and having time to think things through.

- Accommodating Learning Style

People with this learning style have the ability to learn from primarily "hands-on" experience. They enjoy carrying out plans and involving themselves in new and challenging experiences. Their tendency may be to act on "gut" feelings rather than on logical analysis. In solving problems, individuals with an accommodating learning style rely more heavily on people for information than on their own technical analysis. This learning style is important for effectiveness in action-oriented careers such as marketing or sales. In formal learning situations, people with the accommodating learning style prefer to work with others to get assignments done, to set goals, to do field work, and to test out different approaches to completing a project.

The contribution of Kolb learning style to general academic achievement are well supported (e.g Cana Garcia and Hurghes, 2000 Maldonardo,2009). In relation to specific subject matters, learning style were found to significantly predict academic achievement in middle school geography students in Korea (Yoon, 2000). Jones(2001) study indicated that different subject matters such as English, Maths, Science and Social Studies tend to invoke different learning preferences among community college students.

From the foregoing, one can see a relationship between Kolb Learning style dimensions with Field Dependence/Independence dimension. For instance, individual with an assimilating style prefer to learn in isolation, think through, exploring analytical model and donot delight in group work- so it can be reason that just like field independent individuals, the assimilating individuals might not be comfortable with cooperative learning group work. Similarly a diverging individual just like a field dependent individual might be delighted with group work and might show positive attitude to cooperative learning.

(b) Mind Style (Gregorc, 1979)

Gregorc (1979) defined mind style with the dimension of use of time and use of space with four types: abstract random, abstract concrete sequential, abstract sequential, and concrete random. A learner with the abstract random style tends to approach learning holistically and prefer to learn in an unstructured way; whereas a learner with the abstract sequential style inclines to take a logical approach to learning and strong in decoding verbal, written and imagery symbols. A learner with the

concrete sequential style tends to extract information through hand on experiences and prefer well – structured learning environments, whereas a learner with the concrete random style prefers to adopt trial and error, intuitive, and independent approaches to learning. Relevant finding in the literature supported the contribution of mind style to achievement.

O'Brien (1994), reported that concrete sequential type participants tended to have higher grade point averages than participants with other styles among high school students. Rose and Shultz (1999) found that, abstract sequential students performed the best, while abstract random students performed the worse.

(c) Approaches to Learning and Study (Biggs, 1987; Enswistle, 1981)

Biggs's (1978) learning approach model defined three learning styles – surface, deep, and achieving approaches. According to Fan and He (2012), a learner with a surface approach tends to reproduce what is taught to meet minimum requirement a learner with a deep approach aims to understand what is learned. A learner with the achieving approach inclines to maximize his/her learning performance. Concerning this model, Zhang (2000) explained that based on previous researches, the deep and the achieving approaches can be put into one category. This mode just like Witkins FDI construct has been widely investigated in connection with issue of academic achievement across culture and across educational levels (Bernado, 2003, Cano, 2005, Rodriguez, 2009, Zhang, 2000). In general, there are evidences for close association of this model with achievement. The deep approach to learning is often associated with higher academic achievement while the surface approach is related to lower academic achievement.

In relation to this study, it can be deduce that individuals with the deep and the achieving style could be good resources in a cooperative learning group since they usually have a good understanding of a concept.

(d) Thinking Style (Sternberg, 1997)

Thinking style is a style construct proposed by Sternberg (1997). Using "government" metaphorically, he contended that just as there are many ways of governing a society, there are many ways of managing our activities. These ways of managing are thinking style. In this theory of mental self-government, Sternberg conceptualized thinking style into type 1(including legislative, judicial, hierarchical, global and liberal), type I II (including executive, conservative, monarchic and local) type III (including internal, external, oligarchic and anarchic) styles (Fan and He, 2012). According to Fan and He (2012) explained that type I styles are characterize by low degree of structure and cognitive complexity, whereas type II style is characterized by high degree of cognitive simplicity (Zhang, 2002). Type III style may manifest the characteristics of either type I and II Style depending on the stylistic demands of the particular tasks (Zhang and Sternberg, 2005) .Thinking style could contribute to learning achievement in both secondary school and higher education in different cultural contexts(Fan and He, 2012).

(e) Cognitive style (Allport, 1937, Witkin, 1962).

According to Neilsen (2012), in a historical overview reported that the first appearance of the word cognitive style is in Allport (1937). This was supported by Sternberg and Girgorenko (2001), Zhang and Sternberg (2006) they reported that the

origin of the word style is Allport (1937) and they asserted that it was used in association with cognition. However, some authors put forward a diverging claim attributing the first mentioning of the word cognitive style to Gardners (1953) article on Cognitive style in categorizing behavior (Neilsen,2012).

Cognitive style, according to Cassidy (2004) is an individual's typical, habitual mode of problem solving, thinking, perceiving and remembering. Amstrong, Peterson and Rayner (2012) defined it as the individual difference in people's preffered way of processing (perceiving, organizing and analyzing) information using cognitive brain – based mechanism and structure. One of the most common conceptualization of cognitive style is associated with the field dependence-Independence of (Witkin, Dyk, Faterson, Goodnough, and Karp (1962). How does one come to be field dependent or field independent? According to Garrick (1978), the determinants of these two cognitive styles have been a focus of conjecture and research since Witkin and his colleagues introduced the concept. In his review of research, he found that studies stressed different biological factors as causal elements of cognitive style:

- Genetics
- Sex differences
- Damage of the left cerebral hemisphere

Other researchers stressed cultural forces (Graff et al. (2004), which include child-rearing practices (Witkin, Dyke, Faterson, Goodenough, & Karp, 1962); structure of one's society (Witkin (1976), and socio-economic status.

However, in summary, cognitive styles exist and are concerned with the form of cognitive activity; they are pervasive dimensions that are stable over time and value free, which distinguish them from intelligence and other ability dimensions.

However, for this study the field dependent/independent style construct developed by Witkin is chosen due to the following reasons:

- It is a one dimensional model(Fan and He,2011) and can be easily incorporated into the research design
- It is the most widely researched style construct in the field of education
- The instrument (Group Embedded Figure Test) used in measuring field independency has been used across different cultural background with a reliability coefficient of 0.83(Witkinet al.2002). According to Markham (2004), it also has a good reputation in prime source (i.e., Mental Measurement Year Book,1999) for evaluating psychometric instrument.

2.7.1 Field Dependence/ Independence Cognitive Style Construct

The field-dependent/independent (FDI) construct was created by Witkin and Asch (Witkin, 1950; Witkin& Asch, 1948a, 1948b) during studies they conducted concerning how individuals perceive of themselves in space. The Gestalt school of German psychology influenced their work. Witkin and his collaborators originally studied the field-dependent/independent (FDI) construct using two tests, the Body Adjustment Test and the Rod-and-Frame Test to measure how Participants perceive the upright position when it is influenced by a surrounding field. The Body Adjustment Test required that participants sit on a tilted chair, set in a tilted room and adjust their body to the upright position. The Rod-and-Frame Test required that a

participant sit in a completely darkened room and view a tilted luminous rod that is in the center of a tilted luminous frame. The participant was then asked to maneuver the rod until it was positioned in a totally upright manner while disregarding the fact that there was a tilted frame that surrounded it.

It was the extent to which participants depended on visual cues from the surrounding Environment that led to the creation of the field-dependent and field-independent constructs. The field-independent participants believed the rod was in a vertical position when they perceived that it was lined up with their body. On the other hand, the field-dependent participants believed that the rod was in a vertical position when it was lined up with the frame regardless of how the frame is positioned. Witkin and his collaborators then compared the results of the Rod-and- Frame Test with a test created by Gottschaldt (1926) where a participant had been requested to locate a simple figure embedded in a complex diagram. Witkin and his collaborators noted a positive (.54) correlation between the two tests, and found that field-independent participants easily identified embedded objects.

Using the aforementioned foundational studies by Witkins and his colleagues as a base, other researchers have attempted to define and articulate the field-dependent/independent construct in terms of its implications for learning and instruction. Witkin and Goodenough (1981) expanded on these definitions by pointing out that in order to have a fuller understanding of field dependence/independence, it is important to take into account the concept of cognitive restructuring. This concept deals with the ability of an individual to alter or transform a field of information rather than just accept it as it is. Such transformation might entail dividing the field into

separate concepts or by replacing the existing structure with a different structure. Bahar &Hansel (2000) indicated that field independent student could more readily sort out “signals” (relevant) information from “noise” (incidental) information. The differences between field dependent and field independent learner is summarise in the table below.

Table 2.2: Cognitive Style Characteristics of Field Independence and Field Dependence

Field Independence (Analytical)	Field Dependence (Global)
• Solves complex problems and isolated facts	Has difficulty breaking information into isolated facts to use to solve problems
• Separates the relevant from the irrelevant	Has difficulty separating the relevant from the irrelevant
• Recalls information for summarizing	Often does not summarize accurately
• Imposes structure to content	Has difficulty providing structure to content when it is missing
• Encodes information quickly and accurately	Has a slow encoding process and often encodes inaccurately because of difficulty separating facts
• Does well on standardized tests	Often does not do well on standardized tests
• Does well in science and mathematics	Does well in humanities and social sciences
• Has a high working memory capacity	Has a low working memory capacity
• Reflective	Impulsive
• Concerned with mastery of concepts	Concerned with relationships
• Task-oriented	People-oriented
• Independent learner; prefers working alone instead of in groups	Needs direct instruction; prefers to work within small groups
• Flexible in learning situations	Inflexible; has difficulty changing strategies
• Self-reliant	Dependent on others for direction and often seeks help from others
• Relies on intrinsic reinforcement and motivation	Relies on others for reinforcement and motivation

Adopted from Blanton, 2004

According to empirical studies in the literature, significant relationship of FDI to academic performance are strongly supported in secondary schools and higher education (Kirk,2000).Others studies however, investigated relationship between FDI to student's academic achievement in particular subject matter. For instance, Abdollahpour, Kadivar and Abdollahi (2006) found a significant difference between field dependent and field independent group in Math achievement, with the independent group performing better in Math. Also in a related finding, close association between FDI and students achievements in other subject matters, such as Chemistry, Biology and Information Management (Kirk, 2000, Ashiru& Sadiq,2016), were reported. Moreover, a number of studies in the literature address a comparatively new issue concerning the influence of FDI on academic achievement in a nontraditional learning environment such as hypermedia and computer assisted learning. For instance, Spanjer and Tate (cited in Zhang, Sternberg and Rayner, 2012) found that field independent students achieved higher grades and lower failure rate than did field dependent students in a broadcast telecourse. This result is consistent with results obtained in the traditional learning environment. Some findings however, were inconsistent with those obtained in a traditional learning environment. Ku and Soulier (2009) examined whether or not general versus specific learning goals have different effect on adolescent with FDI in a hypertext environment and suggested that field dependent adolescent performed significantly better when they had specific rather than general learning goals. Altun and Cakan (2006) reported that, there is no significant association between academic achievement of the student and their cognitive styles towards computer. However, field dependence/independence, which is

measured on a continuum, has been found to have implications for students studying in science-oriented courses. Researchers have found that field independence positively correlates with student performance in tests related to chemistry content (Danili& Reid, 2005), the degree of cognitive conflict when learning density concepts (Kang, Scharmsann, & Noh, 2004), student performance in introductory programming (Mancy& Reid, 2004).

From the above documented evidences on the characteristics of field dependent (FD) and field independent (FI) learners, one might rightly deduce that the field dependent student (FD) might show positive attitude to cooperative learning instructional strategy because they will be more comfortable learning in the midst of other student. Researchers like Tinajero, Castelo, Guisande, &Páramo(2011) have described the field dependent learners as those who are not comfortable without a teacher. They are also of the position that group work, like cooperative learning can greatly assist the field dependent learner to learn effectively and this could result to possible increase in their achievement scores. However, it could also be argue that the field independent (FI) learners might be happier in the absence of the teacher. They (FI) may tend to get the details of the study material and can easily summarize and recall better the material when the need arises. It therefore follows that, a study like this that will place the FI and the FD in separates homogenous group to be taught in a cooperative learning setting could furnish, a very important insight of the effectiveness of cooperative learning instructional strategy on the attitude and achievement of secondary school students.

2.8 Overview of Related Empirical Studies

The following are highlight of some empirical studies related to this study.Olorukooba(2001) investigated the effect of cooperative learning teaching on the performance and attitude of Chemistry students in Zaria. The research design was a pretest – post-test experimental/control design. The sample was two hundred and sixty four. Two instruments, chemistry achievement test and attitude to cooperative learning instructional strategy inventory were used to generate the data. Data analysis was done using t- test and Mann -Whitney test at 0.05 significance level. The result revealed among others, a significant difference in the achievement and also attitude of the experimental group than the control group. The result also showedno significant difference in the attitude of homogenous and heterogeneous group in term of gender.

Vaunghan (2002) in a study established the effect of co-operative learning teaching strategy of students of varying races. The study took place in Bermuda, which implements a curriculum parallel to that of United States. A pretest posttest, control experimental designed was employed. The test used was the California Achievement Test (CAT). The treatment groups were taught using co-operative learning teaching strategy. The Student Team and Achievement Division (STAD) was adopted. The control group received the traditional teaching. The t- test statistical analysis showed significant difference between the pretest and the posttest scores. In his interpretation, he posited that obtaining positive results with participants outside of the United States, shows that co-operative learning is a universal concept. He encouraged that teachers who educate students of colour should integrate co-operative learning in their daily instructional method to assure all students are given the opportunity to perform at the best of their abilities.

Dyel(2011) investigated the effects of Cooperative Learning Strategy on Academic Performance and Attitude of Basic Science students in large classes in Mangu Educational Zone, Plateau State, Nigeria. Experimental – control group design involving pretest and posttest was used for the study. The population consists of 2,944 students. A sample of 220 subjects of both male and female divided into 110 males and females for the experimental group and 110 males and females for the control group were selected by stratified random sampling technique. The instruments used for data collection are Basic Science Achievement Test (ISAT) and Students' Attitude to Cooperative Learning Strategy Questionnaire (SACLSQ) with reliability coefficient of 0.85 and 0.75 respectively. Three null hypotheses were stated in line with the research questions raised. The data collected were analyzed using t-test statistics and Wilcoxon statistics at a significant level of $p \leq 0.05$. Findings from the analysis of the data revealed that there was significant difference in the mean scores of experimental and control group in favour of experimental group. There was no significant difference in the mean scores of male and female students exposed to cooperative learning strategy and there was significant difference on the attitude of students after being taught Basic Science using cooperative learning strategy. Based on these findings, it was recommended that cooperative learning strategy should be used by Basic Science teachers to teach Basic Science students in large class-sizes at the Junior Secondary School level.

Anowar and Rohani(2012) investigated the effect of cooperative learning on student's achievement and attitudes in secondary mathematics in some selected secondary schools in Bangladesh. A sample of 80 grade nine students (40 boys and 40

girls) participated in a quasi – experimental design study. Two instruments: a researcher made achievement test and an attitude scale were used to generate the data. Data was analyzed using the independent sample t- test. The results showed that cooperative learning had significant effects on Mathematics achievement and attitudes towards Mathematics. The study also found that student performance in Mathematics and attitude toward Mathematics were affected by exposure to the cooperative learning.

Olarewaju(2012) investigated the effects of Cooperative Learning Strategy with Models on Academic Achievement and Retention of some Biology Concepts among Pre-ND students in Kaduna State. A randomly selected sample of 100 students from the four Federal Monotechnic Colleges in Kaduna State made up the subjects for the study. These subjects were divided into four groups; three experimental and one control. A pretest administered to the subjects established their equivalent ability. Quasi experimental control design was adopted. The instrument used for data collection, the Biology Achievement Test (BAT) was developed by the researcher and validated by biology education specialists. The BAT has reliability coefficient (r).89. The subjects in the experimental groups were exposed to treatment, while the subjects in control groups were taught using the traditional lecture method, for a period of six weeks in each case. Six research questions were raised while six null hypotheses were formulated and tested using t test statistics at $P \leq 0.05$ level of significance. The major findings from this study included a significant difference in achievement of biology concepts between the experimental groups and the control group in favors of the experimental groups. There was a significant difference in the retention of biology

concepts between the experimental groups and the control group in favor of the experimental groups. The experimental groups retained biology concepts better than the control group. Based on these findings, it was recommended, among others, that lecturers should be encouraged to use models along with cooperative learning strategy in the teaching of biology concepts in tertiary institutions.

Teweldebrhan (2015) investigated student's attitude towards cooperative learning method in Wolaita Sodo University, Ethiopia second year psychology department students. Based on the quantitative research design employed, forty Eighty (48) participants (30 females and 18 males) were taken as both a population and sample. The necessary data were collected through semi structured questionnaires. After the data were collected, it was critically transcribed and analyzed using both descriptive and inferential statistics methods of analysis particularly mean, standard deviation and Analysis of variance (ANOVA) were used. The result indicates that the participants have a positive attitude towards cooperative learning methods and there was a statistical significant difference between male and female participants in their attitude towards the learning methods. However, female participants had positive attitude than their counterparts. In addition, the finding indicates that there was no statistical significant difference between class levels. The academic performances (Average mark) of the students were found negative strong relationship with student's attitude towards cooperative learning methods. The results of the study also provided an insight on the way student perceive cooperative learning method with recommendations for designing more interactive classroom learning interventions that promote context learning, which in turn foster quality education.

Adesoji and Ibrahim (2009) investigated effects of Cooperative Learning Instructional Strategy and mathematics ability on senior secondary school chemistry students' learning outcome in chemical kinetics. A pretest, posttest control group quasi experimental design was adopted for the study. Data were collected from a sample of 300 students made up of 110 males and 190 females from six senior secondary schools in Epe Division of Lagos State, Nigeria. Analysis of covariance(ANCOVA) was used to analyze the data with pre-test scores as covariates in order to adjust for the Initial differences in the sample. Multiple classification analysis (MCA) was also used to examine the magnitude of the differences among the groups. The findings revealed that there were significant main effects of treatment on students achievement and attitude ($F=190.58$; $P<0.05$) and ($F=379.275$, $P<0.05$) respectively. Mathematics ability had significant main effects on achievement ($F=12.971$; $P<0.05$) and on attitude ($F=3.678$; $P<0.05$). The interaction effects of treatment and Mathematics ability was significant for achievement ($F=8.146$; $P<0.05$) and also for attitude ($F=7.578$; $P<0.05$). Based on the findings, it was recommended that mathematical background of students should be taken into consideration before allowing them to enroll for Chemistry at the senior secondary level. Students with very low mathematical ability should not be allowed to enroll for Chemistry. Students Teams-Achievement Divisions strategy should also be used to teach Chemistry at this level.

Wyk(2012) explored the effects of cooperative learning teaching on student achievement, attitude and motivation in economics education. Quasi-experimental research, a pretest-posttest design was constructed for the purpose of this research. A

proportional stratified sampling was done to select a sample of one hundred and sixty-eight (168).The sample comprised the experimental group(N=85) and the control group (N=83), who were randomly selected from the registered list for module EEE 112. Both groups were taught by the researcher over a 12- week period of twocontact sessions of 55 minutes per week for thefirst semester. Three research instruments, namely:Test of Economic Literacy (TEL);Motivation Scale and Economics Modular Test were used to generate data.

The data was analyzed using the t-test statistical analysis. The result revealed the mean of pretest scores prior to instruction is not significantly different ($t66 = -0.078$, $p<0.05$). The results of post-achievement test however, indicate that the mean of post-test scores for participants in the experimental group that studied STAD as a cooperative learning technique are statistically different from the control group that learned via direct instruction ($t66= -5.231$, $p<0.05$). The result also showed that cooperative learning (STAD) had a significant effect on the attitude of the students towards economic education.

In relation to cognitive style construct, the following empirical studies are related to this study

For instance, Fyle(2009) examined the effect of field dependent/independent style awareness on learning outcomes in a hypermedia instructional module. A two-group posttest only design on one factor (style awareness) was used. The sample consisted of 149 eighth-grade students in 10 sections of a science class taught by two teachers in a public middle school. Sixty-eight (68) students in five sections of the class were assigned to the treatment group (field dependent/independent style

awareness) while the other 81 students in five sections were assigned to the control group (no field dependent/independent style awareness). Data were generated using the following instruments:

- Multiple-choice to measure the achievement
- Paper Sketch design task and a 3-Ddesign task to measure learning performance and
- Learning strategies (navigation strategies) to measure the frequency that specific features on the science Web quest sites were used.

The data were analyzed using the Independent Samples t-test.The findings indicate that style awareness significantly influenced the learning strategies of field-dependent students as they studied and carried out learning tasks in the Web quest. A Web quest is a teacher-designed Web-based instructional module. It has been defined as an inquiry-oriented lesson format in which most or all of the information that learners work with comes from the Web (Dodge, 2007,). Field dependent students with style awareness used hypertext links and navigated the menu sequentially a greater number of times than their counterparts with no style awareness. Correspondingly, there were no significant findings for field-independent students of the effects of style awareness on learning strategies. The findings also revealed significant differences in terms of style awareness and its interactions with achievement on the multiple-choice test. Both field-dependent and field independent students with style awareness achieved higher scores than their counterparts who received no style awareness. There were however no significant findings with respect to the effects of style awareness on performance on the design task. They concluded

that the study demonstrated that providing middle-school students with cognitive-style awareness training can improve both their academic performance as well as enable them to adopt more effective learning strategies when learning in hypermedia environments.

Peklaj(2003) investigated the effects of cooperative learning on achievement in mathematics and native Slovenia language and to analyze students' achievement in cooperative learning according to their gender, abilities and cognitive style. Three hundred and seventy three (170 in the experimental and 203 in the control group) fifth grade students from nine different primary schools participated in the study. In experimental group, cooperative learning was introduced in one quarter of the hours dedicated to mathematics and Slovene language during the school year. Control group received the traditional way of teaching in both courses. The results were analyzed with ANOVA. Positive effects of cooperative learning were found in both courses. Results in cooperative learning group were further analyzed according to students' gender, abilities and cognitive style. No significant interactions on between students' achievement and their gender or abilities were found. Statistically, significant interactions between students' cognitive style and achievement were found in both courses. Field-dependent students benefited most from cooperative learning.

Charoula (2013) carried out an investigation to examine the effects of cognitive style on learners' performance and interaction during complex problem solving with a computer modeling tool. One hundred and nineteen undergraduates volunteered to participate in the study. Participants were first administered a test, and based on their test scores, they were classified into three groups: field-dependent,

field-mixed, and field-independent learners. Participants then received the same set of integrated-format materials and were asked to use a computer modeling tool to solve a complex problem about immigration policy. A multivariate analysis of variance was performed with field type as the independent variable, and cognitive load, problem-solving performance, and learner interaction with the computer tool as the dependent variables. The results indicated that there was no significant difference in terms of the amount of cognitive load reported. However, there was a significant difference in terms of learner problem-solving performance. Specifically, field-independent learners outperformed field-dependent learners, and field-mixed learners outperformed field-dependent learners. The results also indicated significant differences in computer interaction between field-independent and field-dependent learners, and between field-mixed and field-dependent learners. The qualitative findings of the study showed that students who interacted poorly with the software were unsure about how to systematically use the affordances of the computer tool to solve the problem, did not have a goal-directed plan or strategy in mind about how to investigate the issue at hand, and had difficulty with testing the immigration policies by appropriately controlling variables in order to collect data to inform decision making. Implications are discussed in terms of designing computer systems that scaffold learners' complex problem solving by considering the cognitive demands of the task.

Okoronka and Wada (2014) investigated the effect of analogy instructional strategy, cognitive style and gender on senior secondary school student achievement in some physics concepts in Mubimetropolis, Nigeria. Instructional strategy at two levels was crossed with two levels cognitive style and two levels gender which serve as

moderator variables. A 2x2x2 matrix, pre-test, post-test, control group, quasi – experimental design was employed for matching the factors. Data were collected using two validated and reliable instrument namely: the cognitive style test (CST) and the physic achievement test (PAT). A total of 82 senior secondary school (SS2) students took part in the study. Data were analyzed using the mean, t-test, factorial analysis of variance (ANOVA) and Least Significant Difference. The result showed a significant main effect of treatment on achievement and significant interaction effect on achievement when cognitive style was crossed with gender The most effective treatment was the analogy instructional strategy. The result also showed that the FI female and the FD male were homogeneous, while the FI male student and FD females were not in the same homogeneous group.

In a separate but an interesting study, Hseih(2011) investigated the effect of cognitive style on an MSN visual learning companion system as an adjunct of classroom instruction in Taiwan. Thisstudy designed a Chabot system (a computer program which conducts a conversation via auditory or textual methods)Confucius(local institutions, based in U.S. schools, which stimulate and support innovative teaching and learning of Chinese language and culture) as a MSN virtual learning companion to examine how specific application design variables within educational software affect the learning process of subjects as defined by the cognitive continuum of field-dependent and field-independent learners. 104 college students participated in a 12 week Microsoft certification course that used Confucius as an adjunct to classroom instruction. The study considered to what extent the two distinct learning modes offered by Confucius would affect the learning gains of two

distinct cognitive styles. Each of the two learning modes available within the Confucius was designed to conform to the specific requirements of field-independent or field-dependent learners. Data was analyzed using Analysis of Variance (ANOVA).The results of this study reveal that a discussion mode offers far greater benefit to field-dependent learners than to those whose cognitive style is field-independent. Conversely, a lecture mode is substantially more beneficial to field-independent learners than to field-dependent learners.

In a study related to this study, Miller and Pollito(1999)determine the effect of cooperative learning team compositions on selected learner outcomes. The sample consisted of 90 students, including 75 enrolled in a junior level leadership class in agricultural education and 15 enrolled in a senior level agronomy class at Iowa State University. The Group Embedded Figure Test (Witkin, Oltman, Raskin and Karp, 1971) was used to identify learner's cognitive style. They grouped the sample students into four experimental groups namely: Field dependent learners (homogenous group), Field independent learner (homogenous group), Field neutral (homogenous group) and Field mixed (heterogeneous group). The active independent variable was studentteam composition. Five dependent variables were measured including final course grade, grade for team work, percentage of class sessions attended, percentage of team activities attended, and satisfaction with team activities. The instruments used for grading were teacher-made tests and activities. A researcher made test was used to measure the achievement. Analysis of Variance (ANOVA) statistics was used to analyze the data at 0.05 level.The result showed that, heterogeneous team does not achieve higher team activity scores or higher course grade than homogenous team.The

result also revealed that, homogenous team did not report higher attitude (i.e, attendance, satisfaction with team activity) score. However, qualitative data gathered showed the following:

- The researcher observed that teams engaged in behaviors that were consistent with those suggested by cognitive styles theory. The field dependent team enjoyed the greatest amount of group discussion. They were always cheerful and supportive of each other. The field-dependentgroup mixed task and relationship behaviors moreevenly than other teams, but the products of their work focused on people or social issues to a greatextent.
- The mixed group experienced a great deal of difficulty in working together effectively. They physically distanced themselves from each other and engaged in very limited discussion. On oneoccasion, the mixed group finished theirassignment, stopped talking to each other, andeither watched other groups or daydreamed forseveral minute.

However, Miller and Pollito (1999) submitted that there was enough difference in the nature of the team assignments to cause them to wonder if the type and length of the team assignments (numerous short-term assignments vs. one long-term assignment) might be a factor in the nature of these results. In addition, they suggested that, the prudent approach would be to repeat the experiment in another section of the course class.

2.9 Implication of the Literature Reviewed

From the literature reviewed so far, it is evident that emphasis is shifting from the traditional teaching approaches to a more child centered approaches like

cooperative learning teaching strategy.Cooperative learning is a teaching strategy which allows students to work together in small homogeneous or heterogeneous groups with individuals of various talents, abilities, styles and backgrounds to accomplish a common goal. Cooperative learning instructional strategy has been accepted globally as an effective teaching strategy used in teaching and learning of science. In most of the literature cited, cooperative learning teaching strategy led to higher academic gains and positive attitudinal change.

According to empirical evidences cited in this review, several works had been done on cooperative learning research considering individual differences like background, gender, talent and abilities. However, the review showed that little research had considered cognitive style difference as a grouping criterionin a cooperative learning structure. Two international researches: Miller and Pollito (1999) and Liang (2002) cited in the review considered cognitive style–However, the studies are done in a different setting with a different grouping pattern and cognitive style construct. Miller and Pollito(1999) carried out their study in a university setting and not secondary school setting. No study to the best of the current researcher's knowledge had considered the effect of cooperative learning instructional strategy on the attitude and performance of biology students in genetics – using cognitive style as a grouping criterion.

Grouping as shown in the review is a very important stage in cooperative learning. Most of the grouping pattern employed by many researchers in Nigeria, emphasize on heterogeneous grouping base on academic ability or gender. However, the review also revealed that homogeneous grouping can also promote learning

Cognitive style has important implications for learning and instruction. It is also observed in thisliterature review that, the development and/or accommodation of the field-independent style is a factorthat must at least be considered in science learning. The review also showed clearly that field dependent student (FD) and field independent (FI) might not show thesame attitudewith group work. For instanceTinajero et al (2011) and Sadler- Smith (1999), supported that FD would do better under teaching method that encourages interaction between student such as cooperative group instruction – while Miller and Pollito(1999) could not find any significant difference in the achievement of FD and FI grouped homogeneously. This study is poised to validatethese previous findings.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This study investigated the "Effect of Cooperative Learning on Attitude and Achievement of Senior Secondary School Student of Different Cognitive Style". In this chapter, a description of the procedure used for the study is presented. The presentation is done under the following subheading:

3.2 Research Design

3.3 Population of the Study

3.4 The Sample and Sampling Techniques

3.5. Selection of the Topic for the study

3.6 Instrumentation

3.6.1 Validity of the Instrument

3.6.2 Pilot Study

3.6.3 Reliability of the instrument.

3.6.4 Item Analysis

3.7 Administration of the Treatment

3.8 Data Collection Procedure

3.9 Procedure for Data Analysis

3.2 Research Design

The studyadoptedapretest- posttest quasi experimental design. This design does not permit random assignment of subjects to experimental and control groups. Insuch

case intact classes were usedThe Group Embedded Figure Test (GEFT) was administered to the students in order to establish their cognitive style categories (i.e., either field dependent or field independent) based on their cognitive style. After their cognitive style was determined, they were grouped into: HomogenousField Dependent Group (FDH), Homogenous Field Independent Group (FIH) and a Heterogeneous Group which comprised both field dependent and field independent students (FDHT &FIHT). The three above mentioned groups served as the experimental groups. Allthe three experimental groups were taught genetic concepts using cooperative learning instructional strategy (CLIS) while the control group was taught the same genetic concepts using the lecture method. The three experimental groups wereexposed tothe treatment (CLIS) for six weeks. Aposttestwas administered to all four groups to assess the effect of the treatment (CLIS) on the group.

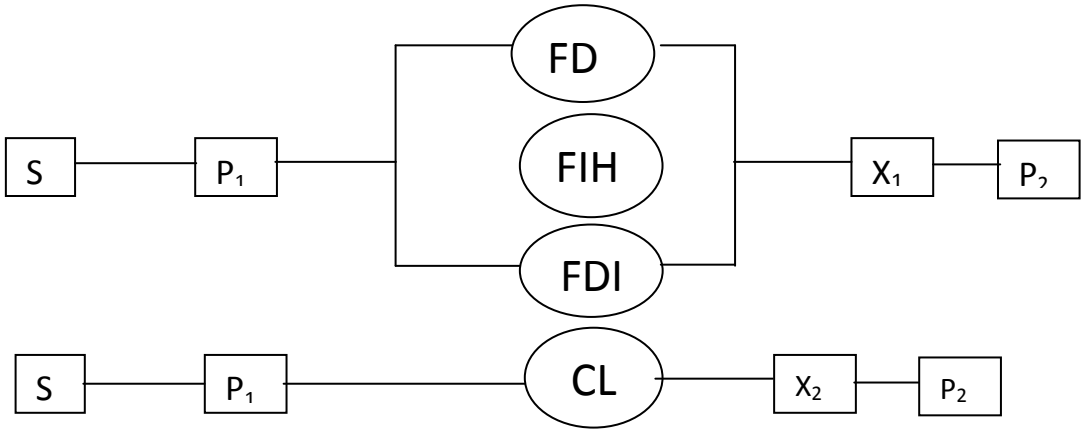


Fig. 3.1: Research Design

FDH = Experimental Group 1(Homogenous FD)
FIH = Experimental Group 2(Homogenous FI)

FDI = Experimental Group 3(Heterogeneous FDI)

CL = Control Group

P_1 = Pretest

X = Treatment

P_2 = Posttest

3.3 Population of the Study

The population of this study was made up of all the SSII senior secondary two biology students offering biology inWAEC accredited private schools in Giwa Educational Zone, Kaduna State. The educational zone cut across three local government areas (Giwa, SabonGari, andHunkuyi).The choice of this educational zone was due to its proximity to the university.There are 15 private senior secondary schools in this educational zone. Fourteen (14)are coeducational while one (1) is boys school. The totalpopulation of SSII a student is1,195.724are male and481 are female. There ages range from 14 – 16 years.

Table 3.1: Population of the Study

S/N	Name	Type	Male	Female	Total
1	Model Learning Secondary School	Co educational	61	59	120
2	Knowledge Is Power Secondary School	Co educational	40	35	75
3	Christ College, Layin Zomo	Co educational	34	32	66
4	Life Line Academy	Co educational	18	14	32
5	Gods Time Secondary School	Co educational	30	19	49
6	ITN Secondary School Zango	Co educational	76	82	158
7	Buks International Secondary School	Co educational	21	18	39
8	Vital Years Sec. School	Co educational	39	08	47
9	Demonstration Secondary School A.B.U Zaria	Co educational	170	80	250
10	Zaria Academy Shika.	Co educational	35	17	52
11	Ibrahim Memorial Secondary School, Layin Zomo.	Co educational	43	27	70
12	St. Joseph Seminary Palladan	Boys	32	-	32
13	Unity School Zango	Co educational	09	12	21
14	Redemption College, Hayin Mallam	Co educational	07	03	10
15	Abdulkarim Memorial Science Secondary School, Giwa.	Co educational	99	75	174
16	**TOTAL**		714	481	1,195

Giwa Educational Zone (2015)

3.4 Sample and Sampling Procedure

From the population of the study, four schoolswere purposively selected to serve as sample. Purposive sampling was chosen because an initial attempt was made to conduct this study in public school however; the environment (i.e., dilapidated structures, absence of furniture and poor supervision) made it impossible. The nature of the research requires that,

- a student to have access to at least a chair and table to write the cognitive test (Group Embedded Figure Test)
- Students to sit round the table and learn cooperatively - not facing the blackboard as commonly obtains in a traditional classroom. This kind of sitting arrangement can only be possible in a laboratory setting.

The four schools selected were Zaria Academy, Shika, Demonstration Secondary School A.B.U, Life line Academy Samaru and VitalYears Secondary School Hanwa. Two pretest were used: Group Embedded Figure Test (GEFT) and Genetic Performance Test (GPT). The (GEFT) was administered in order to categorize the students into field dependent/independent cognitive style while the GPT was administered to establish group equivalence. The four schools were designated as experimental school 1, 2, 3and control school. One intact classes each from thefour schools was used as experimental and control group respectively. The intactclasses were labeled as: Experimental Group 1(FDH), 2(FIH), 3(FDI) and control (CL) group respectively. Intact classes were used in order not to disrupt the school organizational setting. The total number of students in the sample is 95. The sample distribution is presented in table 3.2

Table 3.2: Sample for the Study

	Male	**Female**	**Total**
FDH	08	15	23
FI H	05	18	23
FDI(FD &FI)	08	16	24
LM	10	15	25
Total	**31**	**64**	**95**

3.5 Selection of Genetics Concept Taught

The concepts taught in this study were the concept of genetics. Topics taugh include, mitosis and meiosis, Chromosome and its structure, gene and its structure, monohybrid crossing. The concept of genetics was chosen because of its abstract nature. Interaction with secondary school students revealed that, the concept is often regarded as difficult. This opinion was supported by Chima &Onyebuchi(2011) and Bello(2011).

3.6 Instrumentation

Three instruments were used to generate the data for this study. The instruments are:

1. Group Embedded Figure Test(GEFT)
2. Genetic Performance Test(GPT)
3. Cooperative Learning Attitude Scale(CLAS)

3.6.2 Validation and Description of Research Instruments.

The Genetic Performance Test (GPT) and the Cooperative Learning Attitude Scale (CLAS) were presented to a team of expert for validation. The description of the instruments and the validation procedure were presented below

ValidationandDescription of Genetic Performance Test (GPT)

The GPT is a 25 items objective test instrument adapted by the researcher. The test items were adapted from past WASCE question papers (From 2008 – 2014). The items in the test covered the entire unit taught by the researcher on genetics. A score of 1 was awarded for each correct response. Therefore the total scores in the test was twenty five (25) marks. The GPT was used to generate data on a dependent variable (performance).Specification of test items that reflected the six (6) cognitive levels based on BloomsTaxonomy is presented in table below.

Table 3.3: Table of Specification of Genetic Performance Test

Topics	% weight	Recall	Understanding	Application	Analysis	Synthesis	Evaluation	Total
		40	**28**	**8**	**8**	**4**	**12**	**100**
Mitosis and meiosis	20	3	2					5
Gene	12	2	1					3
Chromosome	16	2	1				1	4
Genetic inheritance	20	2	2			1	1	5
Variation	16	1	2				1	4
Probability	8				2			2
Application of genetics	8			2				2
Total	**100**	**10**	**7**	**2**	**2**	**1**	**3**	**25**

Source: Adapted from Mudasiru(2010)

The Genetic Performance Test(GPT) was presented to a team of expert for both face and content validation. The team comprises of a professor and associate professor in the department of science education, A.B.U Zaria, a Professor of cytogenetic, Biological sciences department A.B.U Zaria and a secondary school biology teacher, who had been teaching biology for at least ten years. The team assisted in the following ways:

- To check and correct any ambiguity in language.
- To examine the adequacy and the appropriateness of the mark scheme.

Feedback from the panel led to re-framing of some of the items (11, 13 and 22) in the GPT and also led to the reduction of the test items from fourty to twenty five.

A sample of Genetic Performance Test (GPT) is presented as appendix I

Description and Validation of Cooperative Learning Attitude Scale (CLAS)

Cooperative Learning Attitude Scale (CLAS) was constructed by the researcher. CLAS was constructed in five Liker Scale (Summated rating Scale). Every statement came along five response categories arranged on an agreement – disagreement continuum (i.e, Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD)).The CLAS was a collection of statements on cooperative learning teaching strategy. The students were directed to select the response category that best represents their reaction to each statement.

In scoring, the numeric values 5, 4, 3, 2, and 1 respectively were assigned to the response categories (i.e. Strongly Agree=5, Agree=4, Undecided = 3, Disagree =2 and Strongly Disagree =1).The sum of the weighs of all the items checked by the students represented the individuals total score. The system means that a high scale score of SA or A to items indicates a positive attitude toward the cooperative learning instruction.

The instrument, (CLAS) was also presented to a team of expert for validation. The team comprises of a professors and an associate professor from science education department and a professor of educational psychology. The panel assistedinchecking to see whether the content of the test actually measured the construct intended, and alsocorrected any ambiguity in language.

After the validation by the panel, some words used in the CLAS were reframed. For instance, an item that read: under cooperative learning no topic is hard was reframed to read, no topic is hard under cooperative learning. Statement no. 9 which read, we asked for help if we have problem was deleted because it was a repetition of statement

no. 8. The total number of items in the instrument CLAS is now 18. A sample ofCLAS is shown in appendix II

Description of the Group Embedded Figure Test(GEFT)

This instrument was developed by witkin,Oltman, Raskin and Karp (1971) and adopted by (Gamon, 2001, Edward, 2008, Fyle, 2009 and Khatib and Hosseipur,2011).The GEFT was adoptedin this present study. The GEFT is perceptual test thathas three sections.The first section consists of seven complex figures. The second and the third section consist of nine complex figures each .The subjects was asked to locate a previously seen simple figure within a larger complex figure which has been designed to obscure or embed the sought – after simple figure.Scoring is done as the number of simple forms correctly traced in the second and third section combined. The total score is 18. The items in the first section were not included in the total score. Those who scored above 12 out of 18 were labeled as FI, and those with a score of 11 and less than 11 were branded as FD cognitive stylists (Kathib and Hosseinpur, 2011). The GEFT is a standardized test instrument with a reliability of 0.82 and 0.79 for male and female respectively (Luk, 1998 and Edward, 2008). However, due to differences in culture and environment the reliability was re- checked using the test retest method. The reliability coefficient calculated was 0.84. This value confirms the instrument as reliable. A sample of the GEFT is attached as Appendix III.

3.6.3 Pilot Test

A pilot test was carried out in one of the schools where subjects werechosen. An intact class of twenty students made up of 9 boys and 11girls was used for the pilot

test. Permission was sought from the school authority to use the senior secondary school two (SSII) students for the pilot test. The researcher met with the students and explained to them that their cooperation is needed for the success of the exercise. The instructions were read to the students. The students were given thirty minutes to respond to the test item. The same procedure was used throughout the pilot study. The purpose of the pilot test was to determine the, feasibility and reliability coefficient of the instrument of the study, most suitable duration for the instruction and to carry out itemanalysis.

3.6.3 Reliability Coefficients of the Instruments

Reliability of an instrument is the degree of consistency with which it measures whatever it is measuring. Reliability coefficient is an index of how reliable a instrument is. The reliability of the three instruments was tested during the pilot test.

In this study, the reliability of Genetic Performance Test was computed using the Kuder- Richardson 21 (1937) procedure. The GPT was administered to the students. They were instructed to answer all questions in thirty minutes. After thirty minutes, the questions and the answers were retrieved. The Reliability Coefficient was calculated using the Kuder- Richardson (1937) method.This method was chosen because,

- it is comparatively least time consuming
- It is applicable to objective test items

The formula is as follows:

$$r_{xx} = \frac{K}{K-1}\left(\frac{s_x^2 - \sum pq}{s_x^2}\right)$$

r_{xx} =Reliability of the whole test

K = number of items on the test

s_x^2 = variance of scores of the total test

The reliability coefficient of the GPT was calculated, using the above procedure as 0.65

However, the reliability coefficient of the CLAS was determined using Cronbach alpha (1951). Researchers use Cronbach alpha when instrument has items that are not easily scored as right or wrong, such as attitude scale or essay tests (Ary et al., 2006). Using the procedure of Cronbach alpha (1951), the reliability coefficient of CLAS was calculated as 0.83. The formula is as follows:

$$\alpha = \left(\frac{K}{K\text{-}1}\right)\left(\frac{s_x^2 - \sum s_i^2}{s_x^2}\right)$$

K = Number of items on the test

$\sum s_i^2$ = Sum of variance of the item scores

s_x^2 = Variance of the test scores

The Reliability Coefficient of the GEFT was calculated using the test- retest method. The instrument was administered twice on two separate occasions to the same class of students. In each occasion, the students were instructed to trace a simple figure hidden or embedded in a complex figure. The researcher allowed the students three minutes to practice the practicing section A as outlined in the instruction. The

researcher then allowed the student to answer question in section B and C using five minute for each section. The booklets were then retrieved and scored. The Reliability coefficient was computed by correlating the scores of the students on the first test with their scores on the second test using Pearson product moment correlation technique. The Reliability coefficient was found to be 0.84

3.6.4 Item Analysis

Item analysis of a test is concerned with evaluation of responses to each test item in a multiple – choice so as to ensure that each test item is valid. GPT was subjected to the following analysis:

- Difficulty Index
- Discrimination Index

3.6.4.1 Difficulty Index (DI)

This is the percentage of students who responded correctly to a test item. The higher the difficulty index, the easier the question is, while the lower the DI the more difficult is the question. The formula to be adopted is as follows:

$$DI = \frac{\text{No of good response} \times 100}{\text{Total response}}$$

A difficulty index (DI) of 30 – 70% shall be considered appropriate (Otu,2012).

Difficulty index of GPT is attached as appendix IV

3.6.4.2 Discrimination Index (DN)

The discrimination index is the power of each of the items to distinguish between high ability and low ability students. The entire students who took or responded to the test items are divided into two –the good half of the class (L) and the

poor half of the class (U) based on their performances in the test. For each test item, the discrimination index was calculated by subtracting number of poor half who responded correctly (GU) from number of good half who responded correctly (GL) to the test item and result divided by the half of number of the entire students. The formula is as follows:

$$DN = \frac{GL - GU \times 100}{1/2T}$$

Where

GL = Number of good half of the students who responded correctly to the test item.

GU = Number of poor half of the students who responded correctly to the test item

T = Number of the entire students.

The discrimination index was established during the pilot test. The result is attached as appendix V

3.7 Administration of Treatment

The treatment was the cooperative learning teaching strategy. The treatment was directed to the following three experimental groups:

- FDH (Homogeneous group) – Experimental Group 1
- FIH (Homogeneous group) – Experimental Group 2
- FDI (Heterogeneous group) – Experimental Group 3

  FDH GROUP consists of subjects with the same cognitive style (i.e, field Dependent Cognitive Style). FIH consists of subjects of the same cognitive style (i.e., field Independent cognitive style). The FDI Group consists of Field Dependent and Field Independent subject.

All the groups weretaught the concept of genetics using the cooperative learning instructional strategy for six weeks.The treatment was in accordance to STAD cooperative model (Slavin, 1987). The treatment is summarized in the flow chart below

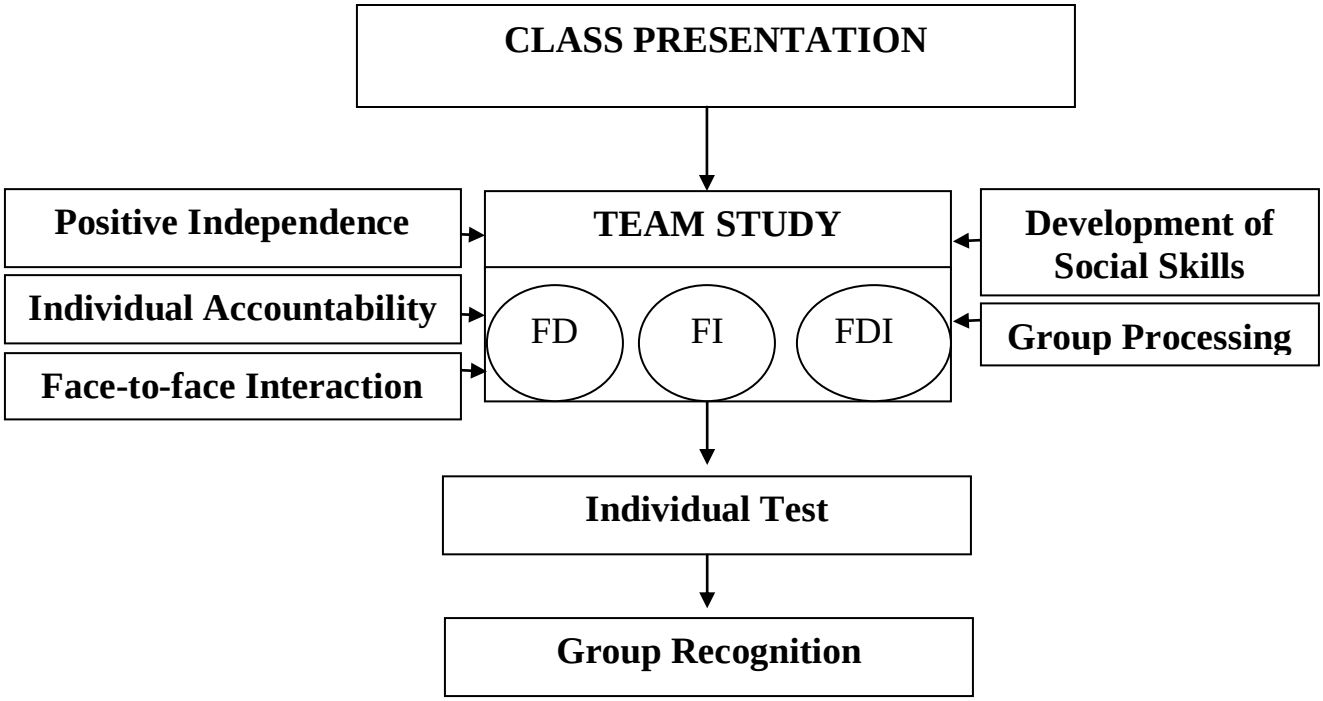


Fig. 3.2: A flow chart of Co-operative Learning Instructional Model
Source: Adapted From Liang,2002

The description of the chart is presented below:

Teacher Presentation

Here the teacher set the direction of the lesson. Presentation can be done through demonstration method, lecture method.

Team study

This isanimportant stage. At the team study stage the student learn the material(s) in a structured group. A structured group is a cooperative learning group

with all the features (i.e., ensuring positive interdependency, individual accountability, promotiveinteraction, development of social skills and group processing) built into it.The researcher provided each group with a teacher created worksheet. The purpose of the worksheet was to enable students to review the section through the use of team practice. Students tutored one another. Team practice involvesstudents working cooperatively to review the worksheet with one another in preparation for a quiz. The researcher presented the worksheet to the team. The question on the worksheet required students to:

a. Summarize the material just presented.

b. Give a reaction to the theory, concepts, or information presented.

c. Predict what was going to be presented next; hypothesize.

d. Solve a problem.

e. Relate material to past learning and integrate it into conceptual frameworks.

f. Resolve conceptual conflict created by presentation.

During the team study, the students were instructed to work according to thefollowing procedure. The procedure was:

a. Each student formulates his or her answer.

b. Students share their answer with their partner.

c. Students listen carefully to their partner's answer.

d. The pairs create a new answer that is superior to each member's initial formulation by integrating the two answers, building on each other's thoughts, and synthesizing.Teacherrole at this stageinclude:

i. Monitoring the group to ensure that students are seeking to reach an agreement on the answers to the questions (i.e., ensure positive goal interdependence is established), not just share their ideas with each other.

ii. Randomly choosing two or three students to give 30 second summaries of their discussions. Such individualaccountabilityensures that the pairs take the tasks seriously and check each other to ensure that both are prepared to answer.

iii. Periodically, the teacher should structure a discussion of how effectively the pairs are working together (i.e., group processing).

In all the groups , throughout the instructional period, cooperative skills like, positive interdependency, promotive interactions, encouraging and supporting other group members, active listening, constructive disagreement e.t.c were ensured by the researcher. In addition to the skills, team members were assigned roles which were rotated occasionally. Role designation and rotation helps strengthen positive independence. The following group roles were adopted from Garfield (1993). These include:

- A "moderator/organizer" is in charge of assigning tasks to the group members, moderating group discussions, overseeing that the assigned task is being carried out, and helping to keep the group
- A "summarizer's" job is to summarize discussions or group solutions to a problem, so that the "recorder" may write down what the summarizer says
- Sometimes it is useful to have a "strategy suggester" or "seeker of alternative methods," who challenges the group to try other methods or explore other ways to solve a problem.

- A "mistake manager" may ask the group what went wrong and what can be learned from mistakes made.
- an "encourager" can be designated to encourage participation from all group members by using probes such as: "What do you think," "Can you add to that?" or by giving positive reinforcement to group members as they contribute to the discussion.

In the STAD model the following team rules were emphasized:

- Students have the responsibility to make sure that their teammates have learned the material.
- No one is finished studying until all teammates have mastered the subject.
- Ask all teammates for help before asking the teacher.
- Teammates may talk to each other softly

Individual Test

After the team study wascompleted, the researcher administered a test to measure the knowledge that students have gained. Students took the individual tests and were not permitted to help each other.

Team Recognition

Team averages are reported in the weekly recognition chart. Teachers can use special words to describe the teams' performance such as science stars, science geniuses, or Einstein's. Recognition of the work of each team occurred by means of a newsletter, handout, or bulletin board that reports the ranking of each team.

3.8 Data Collection Procedure

Data on the two dependent variables, performance and attitude were collected using the Genetic Performance Test (GPT) and Cooperative Learning Attitude Scale (CLAS) respectively. These data were used for statistical analysis.

3.9 Procedure forData Analysis

Data were generated in form of scores. The subject's responses in the genetic performance Test was scored using appropriate marking scheme, while a weighted score was generated using the cooperative learning attitude scale (CLAS). The data generated was used for statistical analysis. For the sake of analysis, the raw data from experimental group 3, the heterogeneous group(comprising of FD FI) were analysed separately.The analysis was done at p= 0.05.This level of significance formed the basis for retaining or rejecting of the null hypotheses that was used in this research work. The hypotheses are restated below with the statistical tool used in testing each.

HO_1 : There is no significant difference in the performance of students taught in the cooperative group and those in the lecture group

This was analyzed using the t- test for independent sample.

$H0_2$: There is no Significant Difference between FD, FI in the Homogenous Group and their counterpart in the Heterogeneous Group. The Analysis of Variance (ANOVA) was used to test this hypothesis.

$H0_3$: There is no Significant Difference in the attitude score between the FD, FI in the Homogenous Group and their counterpart in the Heterogeneous Group.

This was tested using the Analysis of Variance (ANOVA).

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CHAPTER FOUR

ANALYSIS, RESULT AND DISCUSSION

4.1 Introduction

This study investigated Effect of Cooperative Learning Instructional Strategy on the Attitude and Performance of Senior Secondary School Biology Students of Different Cognitive Style. Particularly, the study sough to find what the attitude and performance of field dependent and field independent subjects learning in Homogenous and Heterogeneous Cooperative Learning Group. The data collected was analyzed using the SPSS package at 0.05 level of significance. The analyses of the data collected and the discussions are presented in this chapter. This chapter is presented under the following subheadings:

4.2 Data Analysis and Result Presentation

4.3 Summary of major findings

4.4 Discussion of Result

4.2 Data Analysis and Result Presentation

The data obtained in this study were used in answering the research questions and testing the stated hypotheses. The data were analysed using mean and standard deviation to answer the research questions. However, to test the stated hypotheses, the data were subjected to t – test analysis and the Analysis of Variance at 0.05 level of significance. The results of the analysis are presented in table 4.1 – 4.6.

Research Question 1

What is the difference in mean performance score of students taught in cooperative groups and those taught in lecture? To answer research question 1, the mean and standard deviation of the experimental and the control group were computed. The result is presented in table 4.1

Table 4.1: Mean and Standard Deviation of performance scores of students in the Experimental Control Group.

Groups	N	Mean	Std. Deviation	Std. Error	Mean Diff.
Exp	70	15.46	2.568	.305	2.5
Control	25	12.96	3.434	.687	

Table 4.1 shows that mean performance score of cooperative Learning group as 15.46 while that of the lecture method group is 12.96. This shows that the mean performance score of the Cooperative Learning Group is higher than the Mean performance score of the Lecture Group.

Research question 2

What is the difference between the mean performance score of FD FI in the homogenous group and those in the Heterogeneous group?

To answer research question 2, the mean and standard deviation of the experimental groups score was computed. The result of the descriptive statistics is presented in table 4.2

Table 4.2: The mean and Standard Deviation of Performance Score of FD and FI in Homogenous and Heterogeneous Group

New levels	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
FDH	23	14.96	1.796	.374	12	18
FIH	23	16.04	2.531	.528	10	20
FDHT	13	15.69	2.955	.820	11	20
FIHT	11	15.55	3.174	.957	8	20
Total	70	15.54	2.500	.299	8	20

Table 4.2 shows the mean score of the Field Dependent Homogenous Group (FDH) and the Field Independent Homogeneous Group (FIH) to be 14.96 and 16.04 respectively. The result also showed the mean score of the field Dependent in the Heterogeneous group (FDHT) and the Field Independent in the Heterogeneous Group to be 15.69 and 15.55 respectively.

Research Question 3

What is the difference in Mean Attitude Score of FD and FI subjects in Homogeneous groups and those working in the Heterogeneous Cooperative Learning Group?

To answer this question, the means and the standard deviation of the attitude score of the experimental groups were computed. The result is presented in table 4.3

Table 4.3: Mean Attitude Scores of the Experimental Groups

	N	Mean	Std. Deviation	Std Error
FDH	23	4.2947	.36254	.07559
FIH	23	4.4058	.30724	.06406
FDHT	13	4.3704	.23728	.06850
FIHT	11	4.3426	.26255	.07579
TOTAL	70	4.3524	.30676	.03667

The result in Table 4.3 showed the mean and standard deviation of the attitude scores of the Experimental Groups. The result revealed the mean attitude score of the Field Dependent Homogeneous Group (FDH) to be the lowest (4.2947) while the Field Independent Homogeneous (FIH) Group has the highest (4.4058). The mean Attitude Scores of the Field Dependent (FDHT) and Field independent (FIHT) in the Heterogeneous Group are 4.3704 and 4.3524 respectively.

4.3 Hypotheses Testing

The following hypotheses were tested using the t-test statistical Analysis of Variance at 0.05 level of significance.

HO_1: There is no significant difference in the performance of students in the Cooperative Learning Group and those in the Lecture Method Group. This hypothesis was tested using the t - test analysis at 0.05 level of significance. The result is presented in table 4.4.

Table 4.4: t–test Analysis of the Performance Mean Score of the experimental and the Control group

Groups	N	Mean	Std. Deviation	Std. Error	t-value	DF	P-value	Decision
Exp. Group	70	15.46	2.568	.305	3.827	92	.000	Significant
Control Group	25	12.96	3.434	.687				

P< 0.05

Table 4.4 above showed the result of the t- test analysis of the performance scores of the Experimental Group and the Control Group. The result revealed a p value lower than the set significant level of $P < 0.05$. The null hypothesis which stated that, there is no significant difference between the mean score of the cooperative learning group and that of the lecture Group is therefore rejected.

H_{O2}: There is no significant difference between the mean score of FD and FI in the Homogenous Group and those in the Heterogeneous Group.

To test this hypothesis, the posttest performance scores was subjected to Analysis Of Variance at 0.05 level of significance. The result is presented in table 4.5

Table 4.5: ANOVA of the scores of the Experimental Groups

Source	Sum of Squares	Df	Mean Square	F	P.value	Remark
Between Groups	13.962	3	4.654	.736	.534	Not Significant
Within Groups	417.410	66	6.324			
Total	431.371	69				

P< 0.05

The result of the analysis revealed the F- Cal as .736 and the P value .534 which is higher than the level of significance set at p< 0.05. This is an indication that there is no significant difference in the performance of the student in different cognitive groups compared. Thus the null hypothesis which states that there is no significant difference among the performance of the subjects in the groups is retained.

H_{03}: There is no significant difference in the Mean Attitude Score of FD, FI Homogenous Group and their counterpart in the Heterogeneous Group. The hypothesis was tested using the Analysis of Variance. The result is presented in table 4.6

Table 4.6: Analysis of Variance of the Attitude Scores of the Experimental Groups

	Sum of Squares	Df	Mean Square	F	P-value	Decision
Between Groups	.147	3	.049	.510	.677	Not Significant
Within Groups	6.346	66	.096			
Total	6.493	69				

The Analysis of Variance in table 4.7 revealed an F Cal of 0.510 and a P value of 0.677. The P value is more than the set level of significance, p< 0.005. This indicates that there is no significant difference between the mean Attitude Scores of the Field Dependent and Field Independent students in the Homogeneous Group and their counterpart in the Heterogeneous Group. The hypothesis which stated that there is no significant difference between the attitude of students of different cognitive style groups is therefore retained.

4.4 Summary of the Findings

The summary of findings from the results are presented below

1. The mean performance score of students in the cooperative learning group is higher than that of the lecture group.
2. There is variation in the mean performance score of the groups; Field Dependent Homogenous Group (FDH) has the lowest (14.96) while the Field Independent Homogenous Group has the highest (16.04). The mean Attitude score of the FDH is the lowest (4.2947) while the mean attitude score of the FIH is the highest (4.4058).
3. The result showed that,thereexists a significant difference between the mean performance scores of the subjects in the Cooperative Learning Group and the Lecture Group.
4. There is no significant difference between the mean performance score of Field Dependent and Field Independent subjects in the Homogenous Group and their counterparts in the Heterogeneous Group.

5. There is no significant difference in the mean attitude score of the FD and FI Homogenous Group and their counterpart in the Heterogeneous group.

4.4.1 Discussion of the Findings

The main objective of this study is to find out the attitude and Performance of Field Dependent and Field Independent subjects taught in a homogenous and heterogeneous Cooperative Learning groups. Data generated from the administration of the instruments, Genetic Performance Test (GPT) and Cooperative Learning Attitude Scale (CLAS) were analysed according to the Research Questions and hypotheses earlier stated. The discussion of the result is as follows.

4.4.2 Research Question and Hypothesis One

The result in table 4.4 showed that there is significant difference between the mean scores of subjects taught under the cooperative Learning Group and those taught in the Lecture Group. This could be attributed to the fact that in cooperative learning, students are actively involved in the learning process.According to Gillies(2006), when students work cooperatively together, they show increased participation in group discussions, demonstrate a more sophisticated level of discourse, engage in fewer interruptions when others speak, and provide more intellectually valuable contributions – and this undoubtedly lead to higher performance score. Another reason could be that the interaction between students in the group leads to the expansion of the cognitive frame leading better understanding of the learned material. The STAD method employed in this study engages the students in a quiz at the end of every

lesson, this also could have added to their determination to study and learn the material effectively.

The concept of genetics taught the students in the two groups was relatively new and those in the lecture group could have been at disadvantage due to the fact that, coverage of content, passivity of the students and little room for discussion might have contributed to the lower performance. This result is in agreement with Olurookoba (2002) and Dyel (2011) and Olarewaju (2012) who reported higher mean scores in favor of the cooperative learning Groups.

Research Question 2 and Hypothesis 2

The result in table 4.5 showed there is no significant difference in the mean performance score of the different cognitive style grouping pattern. The performance of Field Dependent and Field independent in all the groups does not vary significantly. Contrary to report in the literature (Cao, 2006), that the field independent performed better than the field dependent, in this study, the Field dependent subject learning in Cooperative Learning group perform equally well as their Field independent counterparts. A possible explanation is that the field dependent subjects who have been described as more socially inclined might have enjoyed the social nature of cooperative learning environment. The assistance of team members in explaining the material one to another – could have led to more understanding and better performance. It has been suggested that the most directive and supportive methods like cooperative learning, are the most suitable for field-dependent students, because of their tendency to trust in external references and their passive attitude towards learning **(**Tinajero, Castelo,Guisande&Páramo, 2011). Field independents as described

by literature as having the ability to separate the relevant from the irrelevant (Bahar & Hansell, 2000), can encode information more accurately and quickly than Field Dependents (Richardson & Turner, 2000), being more reflective and more comfortable without the teacher. In this study however, for the performance of the Field Independent not to be significantly better than the Field Dependent subject, itmight be induce that the Field independent subject might have found cooperative learning environment cognitively distracting. This seems to agree with the report of Summerville (1998) that, Field Independent assigned to an instructional environment designed to address the special need of Field Dependent, often blame their lack of success on external source. The result also agreed with the findings of Cao(2006), who found that altering the instructional environment to cater for the need of Field Dependent learner lead to decrease performance in Field Independent subjects.

The performance of the Field Dependent and the Field independent subject working together in a heterogeneous group, contrary to expectation,was not significantly better than the counterparts in the homogeneous group. It was expected that heterogeneity, that is having the field dependent and independent cognitive style individual learning together would lead to better performance. This could be attributed to the fact that cognitive style might not connote academic ability. Another possible reason could be, the presence of the two cognitive style individual might have led to conflict or disagreement which could not be resolve possibly because of limited time. The result concur with the result of Miller and Pollito(1999) which showed no significant difference between the achievement scores of heterogeneous(in term of field dependency) cooperative learning group and the homogeneous group.

Research Question 3 and Hypothesis 3

The result in table 4.3 showed that the attitude of field dependent and field independent in both homogenous and heterogeneous groups are positively high; however, there is no significant difference in the mean attitude score of the various groups of different cognitive style. It is expectedthat the attitude of field dependent subjects toward cooperative learning instructional strategy will be positively high. The field dependent individuals have been described as people that are socially oriented and more comfortable with group work. It can be induced from this result that, the cooperative learning instructional strategy offered them an opportunity to socialize and also to interact with their team members and this might have led to a more positive attitude.

The results in both table 4.3 and 4.6 also showed that the attitude of field independent to be positively high but, does not vary significantly with that of the field dependent subjects in both homogenous and heterogeneous group. The reason for this result might be connected to the fact that, field independent subjects being more task oriented and more comfortable without a teacher might have found the cooperative learning environment interesting.

Attitude is an affective component and the reason for this result might be attributed to the fact that active participation of the students in cooperative learning groups chases away boredom. Another reason might be the lack of competitive atmosphere that characterizes cooperative learning group learning, cooperation among members could have helped in reducing anxiety and fear during learning. Similar result was reported by Miller and Politto(1999) showing that cooperative learning

teams formed to achieve homogeneity of cognitive styles do not report more positive attitude than the heterogeneous group.It can also be induced that all the cognitive style groups have positive attitude towards Cooperative Learning Instructional Strategy.According to Lord (2001), students taught under Cooperative Learning seem to be happier and satisfied.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

In this chapter, the summary of the objectives of the study, procedure for data collection and analysis and the key findings from the analysis are presented. The conclusion, recommendations, limitations of the study and suggestions for further studies are also presented. This chapter is presented under the following sub headings

5.1 Summary

5.2 Major findings

5.3 Conclusions

5.4 Recommendations

5.5 Limitations of the study

5.6 Contribution to knowledge

5.7 Suggestion for further study

5.1 Summary

The study was designed to investigate the effect of Cooperative Learning Instructional Strategy on the Attitude and performance of biology students of different cognitive style. Three research questions and three null hypotheses were stated.

From the 15 private schools with a total population of 1,195, four schools were purposively sampled. The sampled population is 95 students. All the four schools were pretested using the group embedded figure test and the genetic performance test in order to establish cognitive style and group equivalence respectively. The

experimental groups were designated, according to the cognitive style of the students as Field Independent Homogenous (FDH), Field Independent Homogeneous(FIH) and a Heterogeneous group, FDI (which consist of FD and FI). The experimental groups were taught using the Cooperative Learning Instructional Strategy for six weeks while the control group was taught using lecture method. Three instruments were used to generate the data for this study.

A standardized test, Group Embedded Figure Test (GEFT) was used to establish the cognitive style of the students. Those that scored 12 and above were labeled Field Independent while those that score below 12 are Field Dependent. The Genetic Performance Test(GPT) and the Cooperative learning Attitude Scale (CLAS) were used to generate the performance score and the attitude score respectively. The scores were analysed using simple descriptive statistics, t- test and the ANOVA. The summary of the findings is presented below.

5.2 Major findings

The major findings in the study show that;

a. The mean performance scores of subjects in the Cooperative Learning Groups is higher than the Lecture Method Group.

b. There is no significant difference in the mean performance scores of Field Dependent and Field Independent subject in homogeneous group and those in heterogeneous.

c. The result of this study also showed that cooperative learning instructional strategy is effective in reducing cognitive style inequality in the performance score of the Field Dependent and Independent subject.

d. The attitude of Field Dependent subject did not differ significantly with that of the Field Independent subjects in both Homogenous and Heterogeneous Group

5.3 Conclusions

Based on the result and the findings from this study, the following conclusions can be made;

a. The cooperative learning instructional strategy enhanced the performance of senior secondary school students of both dependent and independent cognitive style in genetics.

b. Field dependent and field independent working in both homogenous and hetero generous cooperative learning groups did not differ in performance which tends to show that cooperative learning teaching strategy could benefit students of different cognitive style.

c. Both Field dependent and field Independent subjects working in Homogenous and those in the heterogeneous group expressed positive attitude towards cooperative instructional strategy. Thus students, independent of their cognitive style express inclination to learning in cooperative groups.

5.4 Recommendations

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

a. Cooperative Learning Instructional Strategy should be used to help the field dependent students learn effectively, it was shown to make field dependent learners learn as well as the field independent learners.

b. Workshops and seminars should be organized to train teachers on how to teach using different cooperative learning models.

c. Learners were found to have positive attitude toward cooperative learning instructional strategy, it could be used to motivate learners learn biology in secondary school.

5.5 Limitations of the Study

The following limitations were evident. They include:

1. The study was restricted only to Giwa Educational Zone, Kaduna State and only private schools were used. Therefore the findings cannot be generalized to other Educational Zones in the State.

5.6 Contribution to Knowledge

1. The STAD study established that field dependent learners performed equally good as their field independent counterpart when taught using cooperative learning instructional strategy.
2. It was observed that field dependent learner and field independent learners working in homogenous and heterogeneous group both show positive attitude toward cooperative learning instructional strategy.
3. It was observed that field dependent learner and field independent learners working in homogenous and heterogeneous group; do not differ significantly in performance.

5.7 Suggestion for further Studies.

1. This study can be replicated in others Educational zones in the state
2. The same study can be tried in public schools with fairly or adequate infrastructure.
3. Others cooperative learning models like Team Game Tournament, Jigsaw, Learning Together can be employed in teaching secondary genetics.
4. The study can be tried in tertiary institutes like Colleges of educations, polytechnics and universities.
5. Other branches of biology like physiology, ecology , evolution can be used for the same study

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APPENDIX I

Genetic Performance Test

Instruction: Answer all the Questions, Kindly Circle the Correct Answer from the options A – D.

1. The genetic makeup of an organism is described as its
   A. Phenotype
   B. Genotype
   C. Character
   D. Chromosome
2. Which of the following variation is applicable to a weight lifter?
   A. Continous variation
   B. Discontinous variation
   C. Hereditary variation
   D. Acquired variation
3. The haploid number of chromosome in man is
   A. 48
   B. 24
   C. 42
   D. 23
4. Which of the following best describes a homologous chromosome? They are,
   A. Product of the division of chromosome
   B. Two identical chromosome from each parent
   C. Chromosome arrange on spindle fibres during cell division
   D. Shapeless chromosome
5. In a mitosis , all daughter cells ends up with
   A. exact number of chromosome as the parent cell
   B. twice the number of chromosome found in parent
   C. less number of chromosome as in parent cell
   D. more number of chromosomes than in the parent cell

6. Chromosome number in human somatic cell is

   A. 23

   B. 34

   C. 46

   D. 48

7. The differences existing in members of the population is refer to as

   A. population difference

   B. variance

   C.variation

   D. mutation

8. DNA refers to

   A. Dinucleic acid

   B. Deoxyribonucleic acid

   C. Dinucleotide amide

   D. None of the above

9. Heredity can be define as

   A. Transmission of character from parent to offspring

   B. Crossing of plant

   C. Gene manipulation

   D. population study

10. Which of the following is not true of gene

    A. it is located in the chromosome

    B. it is the same in number in all organism

    C. it controls characteristics of organism.

    D. It can be transmitted from parent to offspring.

11. As a genetic counselor, what would be your advice to an intended couple with a genotype SS and AS respectively

    A. They should go ahead and marry

    B. They should wait at least for a year

    C. Not to go ahead with the marriage

    D. Take the required drugs

12. The tail of twenty (20) Agama lizard was measured and it was observed that the tail length were not the same. This type of variation can be describe as
    A. pathological
    B. physiological
    C. continuous
    D. none of the above
13. Chromosomes lined up at the equator of the spindle. This statement describes the
    A. prophase stage
    B. meiotic stage
    C. metaphase stage
    D. anaphase
14. An accident scar on the face of a mother cannot be inherited by her daughter because
    A. It is acquired
    B. she is a woman
    C. it won't look good on her
    D. it not supported by the environment.
15. When gametes from pure breeding parents with contrasting features such as tallness and shortness are involve in a monohybrid cross, the offspring in the first filial generation are usually
    A. Pure breed
    B. heterozygous dominant
    C.Homozygous recessive
    D.Mutants.
16. Two individuals both heterozygous(AS) give birth to a child, what is the probability that the child would be homozygous (AA)
    A. 2/4
    B. 1
    C. ¼
    D. 3/4

17. Both plant (TT) and plant (Tt) are phenotypically tall, which of the following test can establish their difference

A. Monohybrid cross

B. Good cross

C. Test cross

D. Silent cross

18. Which of the following is not true of chromosome

A. they are found in the nucleus

B. they are thread – like in structure

C. they are the same in all cells

D. they are hardly involve in cell division.

19. Mitosis is involve in the following processes except

A. Spore formation

B. Growth

C. Gamete formation

D. Vegetative propagation

20. The following are application of genetics except

A. Improvement of crop yield

B. Counselling for genetic disorder

C. hybridization

D. None of the above

21. A bald headed man (BB) married a carrier lady (Bb). What is the probability of having a bald headed child in the F1 generation

A. ½

B. ¼

C. 2/4

D. 1

22. Gene is often located in chromosome at a point known as:

A. Chiasmata

B. locus

C. gene point

D. cross point

23. If a cross is made between a pure breeding red flowered plant and a pure breeding white flowered plant where R is dominant for red flower and r recessive for white, the most likely result of F1 generation will be

A. 75%flowers & 25% white

B. all red flowers

C. 75% white and 25% red

D. 50% red 50% white flower.

24. Tongue rolling can be categorize as

A. Morphological variation

B. genetic variation

C. physiological variation

D. chromosomal variation

25. A process by which homologous chromosomes pair up is called

A. bivalency

B. chiasmata

C. synapsis

D. crossover

APPENDIX II

Cooperative Learning Attitude Scale (CLAS)

Group…….

Section A.

Dear students,

Please give your responses for each of these items by ticking the given scale

S/N	Item	Strongly Agree (SA)	Agree (A)	Undecided (U)	Disagree(D)	Strongly Disagree(SD)
		5	4	3	2	1
1.	Cooperative learning help me to get higher grade in biology					
2	Cooperative learning enhance my thinking ability					
3	My understanding of genetics concept becomes more during cooperative learning					
4	Cooperative learning improves the performance of our group in genetics					
5	Under cooperative learning is like no topic is hard					
6	Explanation by a teammate always help my understanding					
7	Working in group makes me to pass my test					
8	We asked for help if we have problem					
9	I feel important when others listen to me					
10	Other members had given me encouragement					
11	Cooperative learning has provided me an opportunity to socialize with others					
12	Cooperative learning has increased the support and help I received					

	from teammate					
13	I have opportunity to work collaboratively with others instead of alone					
14	We shared the idea and information with others					
15	We are always saying thank you to each other					
16	We are concern with each other progress.					
17	Working in groups makes biology more fun and interesting.					
18	When learning genetics in a group, I never missed a class					

APPENDIX IV

ITEM ANALYSIS OF GENETIC PERFORMANCE TEST(DIFFICULTY INDEX)

ITEM	DF
1	70%
2.	35%
3.	45%
4.	30%
5.	30%
6.	50%
7.	65%
8.	45%
9.	40%
10.	65%
11.	65%
12.	60%
13.	35%
14.	30%
15.	35%
16.	40%
17.	30%
18.	35%
19.	35%
20.	25%
21.	50%
22.	30%
23.	30%
24.	30%
25.	45%

APPENDIX V

ITEM ANALYSIS FOR GENETIC PERFORMANCE TEST(DISCRIMINATION INDEX)

ITEM	Di
1	0.5
2	0.6
3	0.5
4	0.4
5	0.6
6	0.4
7	0.4
8	0.6
9	0.4
10	0.5
11	0.6
12	0.4
13	0.4
14	0.6
15	0.4
16	0.4
17	0.6
18	0.4
19	0.5
20	0.4
21	0.6
22	0.6
23	0.5
24	0.5
25	0.4

APPENDIX VI

COOPERATIVE LEARNING LESSON PLAN

Lesson One

Class: SSII

Time: 1hr

Instructional Strategy: Cooperative Learning Instructional Strategy

Model: STAD

Topic: Mitosis

Instructional Objectives: At the end of this lesson, student should be able to

1. Define mitosis
2. Describe the position of the chromosome at metaphase and anaphase stage
3. List out the significance of mitosis in living organism

INTRODUCTION (Presentation Phase)

Mitosis is a type of cell division that produces daughter cells with the same number of chromosome as the parent cell. It is the type of cell division that takes place during processes like: growth, repair of cell, replacement, regeneration, asexual reproduction among others.

Team Study

You are to observe the following cooperative activity principles, which are permanently pasted on the classroom board.

1. Students have the responsibility to make sure that their teammates have learned the material.
2. No one is finished studying until all teammates have mastered the subject.

3. Ask all teammates for help before asking the teacher.
4. Teammates may talk to each other softly.
5. Remember to say thank you to each other.

Activity 1a: Using the following material: Cardboard, gum, Thread, rubber twig, beads, model, wires, depicts the:

- Anaphase mitotic stage
- Metaphase mitotic stage

Activity 1b: Using the worksheet provided:

Draw a parent cell with four chromosomes

- Draw a daughter cell resulting from the division of the above parent cell
- Use the material provided and model the parent and the daughter cell
- From the study materials provided, defined mitosis
- List out four significance of mitosis
- Describe the position of the chromosome at metaphase and anaphase

Test/ Evaluation

Here the teacher gives a test to the students. The students are tested individually on what they have learnt in their group.

Question

- Define mitosis
- List five significance of mitosis

- Describe the position of chromosome during metaphase
- In mitotic division, a parent cell with eight(8) chromosomes ends up with a daughter cell with ---------- number of chromosome

Recognition Stage

Groups are recognized by pasting group average grades on the recognition chart. The teacher can use special words to describe the team's performance such as science stars, science geniuses, or Einstein's.

Lesson Two

Class: SSII

Time: 1hr

Instructional Strategy: Cooperative Learning Instructional Strategy

Model: STAD

Topic: Meiosis

Instructional Objectives:

INTRODUCTION (Presentation Phase)

Meiosis is a type of cell division that results in the daughter cell having half of the number of chromosome of the parent cell. It is the type of cell division that takes place during gamete formation, spore formation.

Team Study

You are to observe the following cooperative activity principles, which are permanently pasted on the classroom board.

1. Students have the responsibility to make sure that their teammates have learned the material.

2. No one is finished studying until all teammates have mastered the subject.

3. Ask all teammates for help before asking the teacher.

4. Teammates may talk to each other softly

Activity2:

Using the following material: scissors, cardboard, gum, Thread, rubber twig, beads to model

- Metaphase 11,

- Anaphase 11 and
- Telophase

Activity 3

Study the material before you and answer the following question in your worksheet

- List out three difference you notice between meiotic cell division and mitotic cell division
- At what stage in meiosis does halving of chromosome take place
- Define the following terms : synapsis, bivalent and crossing over
- Describe the processes that take place during crossing over and explain why these processes are significant.

Test/ Evaluation

Here the teacher gives test to the students. The students are tested individually on what they have learnt in their group. The sum of each student contribution points to his group as calculated from his base score in the previous test represents the group score.(i.e., as described in the chapter above)

Recognition Stage

Groups are recognized by pasting group average grades on the recognition chart.The teacher can use special words to describe the team's performance such as science stars, science geniuses, or Einstein's.

Lesson Three

Class: SSII

Time: 1hr

Instructional Strategy: Cooperative Learning Instructional Strategy

Model: STAD

Topic: Gene

Instructional Objectives: At the end of this lesson, student should be able to

1. Describe the position of gene in relation to the chromosome
2. Explain genotype
3. Describe the components of the DNA
4. Define allele

INTRODUCTION (Presentation Phase)

Gene is the heredity material found in chromosome of cell. The gene determines the character of an organism. Gene occurs in pair in all cells except in sex cell (gamete). The genetic makeup of an organism is often refer to as genotype. Genes are often represented by letters

Team Study

You are to observe the following cooperative activity principles, which are permanently pasted on the classroom board.

1. Students have the responsibility to make sure that their teammates have learned the material.
2. No one is finished studying until all teammates have mastered the subject.
3. Ask all teammates for help before asking the teacher.

4. Teammates may talk to each other softly.
5. Always say thank you to one another

Activity3a:

Using the following material: cardboard, gum, Thread, rubber twig, beads, and letters to model,

a) Gamete of parent cell of the following genotype: BB, Bb, bb,

Activity 3b:

Study the material in your group and answer the following question on the group worksheet

- Differentiate between genotype and phenotype
- Define alleles
- What is a locus
- What is the full meaning of DNA?
- What is the relationship between alleles and gene

Lesson Four

Class: SSII

Time: 1hr

Instructional Strategy: Cooperative Learning Instructional Strategy

Model: STAD

Topic: Gene II

Instructional Objectives: At the end of this lesson, student should be able to

1. Describe homozygosity and heterozygosity
2. Describe recessive and dominant gene
3. Illustrate to your group what genotype and phenotype entails.

INTRODUCTION (Presentation Phase)

Gene is the heredity material found in chromosome of cell. The gene determines the character of an organism. Gene occurs in pair in all cells except in sex cell (gamete). The genetic makeup of an organism is often refer to as genotype. Genes are often represented by letters

Team Study

You are to observe the following cooperative activity principles, which are permanently pasted on the classroom board

Activity3c:

With respect to the gene for fruit taste (S), use the material provided and model a

i. Homozygous organism ii. Heterozygous organism

ii. Recessive gene and dominant gene

iii. Explain to your team members the meaning of above terms

Test/ Evaluation

Here the teacher gives test to the students. The students are tested individually on what they have learnt in their group. The sum of each student contribution points to his group as calculated from his base score in the previous test represents the group score. (i.e., as described in the chapter above)

.**Recognition Stage**

Groups are recognized by pasting group average grades on the recognition chart. The teacher can use special words to describe the team's performance such as science s tars, science geniuses, or Einstein's.

Lesson: Five

Class: SSII

Time: 1hr

Instructional Strategy: Cooperative Learning Instructional Strategy

Model: STAD

Topic: Chromosome and its structure

Instructional Objectives: At the end of this lesson, student should be able to

1. Define chromosome
2. Describe homologous chromosome using the instructional material provided
3. Describe haploid and diploid cells
4. Distinguish between a gamete and body cell
5. Describe a homologous chromosome

Introduction (Presentation Phase)

Chromosomes are genetic vehicle of a cell. In other word, genes are borne on the chromosome. They are threadlike structure found in the nucleus of cell. The number of chromosome can either be diploid (2n) or haploid (n)

Team Study Phase

You are to observe the following cooperative activity principles, which are permanently pasted on the classroom board.

1. Students have the responsibility to make sure that their teammates have learned the material.

2. No one is finished studying until all teammates have mastered the subject.

3. Ask all teammates for help before asking the teacher.

4. Teammates may talk to each other softly.

Activity 3a

a) Using the following material: cardboard, gum, Thread, rubber twig, beads, and letters to model a cell with

- A pair of chromosome
- Two pair of chromosome

b) Using the diagram in the material as a guide to depict:

- a cell with a pair of homologous chromosome carrying the same kind of gene
- A cell with a pair of homologous chromosome carrying different kind of gene
- A haploid cell and a
- A diploid cell

Activity 3b

Study material before you and answer the following questions in your worksheet

- Define chromosome
- Differentiate between auto some and sex chromosome
- What is a homologous chromosome
- How many pair of chromosome is found in human body cells?
- In term of chromosome numbers , how can you differentiate between a body cell and a gamete cell

Test/ Evaluation

Here the teacher gives test to the students. The students are tested individually on what they have learnt in their group. The sum of each student contribution points to his group as calculated from his base score in the previous test, represents the group score.(i.e., as described in the chapter above)

Recognition Stage

Groups are recognized by pasting group average grades on the recognition chart. The teacher can use special words to describe the team's performance such as science stars, science geniuses, or Einstein's.

Lesson six

Class: SSII

Time: 1hr

Instructional Strategy: Cooperative Learning Instructional Strategy

Model: STAD

Topic: Monohybrid Crossing/Inheritance

Instructional Objectives: At the end of this lesson, students should be able to,

1. Define monohybrid crossing/inheritance
2. Describe a monohybrid crossing showing the F1 and the F2 generation
3. Describe genetic ratio
4. Describe phenotypic ratio
5. Describe the term pure breed

Introduction (Presentation Phase)

Mendel conducted a lot of experiment were He crossed plant of different character to know how the characters are transmitted from parents to offspring. In one of the crosses, He crossed two parent plants that differed in one character (i.e, height).For instance one of the parent is tall and the other short. This type of crossing is known as monohybrid crossing.

You are to observe the following cooperative activity principles, which are permanently pasted on the classroom board.

1. Students have the responsibility to make sure that their teammates have learned the material.

2. No one is finished studying until all teammates have mastered the subject.

3. Ask all teammates for help before asking the teacher.

4. Teammates may talk to each other softly.

Team Study Phase

Activity4a

Using the following material: cardboard, gum, Thread, rubber twig, beads, and letters to model,

I. An albino, aa married a normal lady AA. Using the appropriate letters provided, model a punnett square of F1 generation.

II. Model a crossing between two of the F1 offspring of the above cross to show the F2 generation

Activity 4b

Study the material before you and answer the following question

- How many of the offspring are tall in II above?
- Why was there no offspring that was short?
- Closely examine the F2 generation offspring and explain why the offspring are now mixed phenotypically.

Activity 4c

b) Two containers (A and B), A containing ten red cards and the other B containing ten blue cards. Close your eye and pick one card from the container (A) and one from container (B). Repeat the exercise until you pick all the cards in the two containers.

Question(s)

- Why couldn't you bring out a red card from container B?

- Can a blue bead come out of container A?
- What is pure breed
- What other name use for pure breed?
- Write down on a card four example of a pure breed
- Explain to your team members what is meant by test cross and why is this type of cross used.

Test/ Evaluation

Here the teacher gives test to the students. The students are tested individually on what they have learnt in their group. The sum of each student contribution points to his group as calculated from his base score in the previous test represents the group score.(i.e., as described in the chapter above)

Recognition Stage

Groups are recognized by pasting group average grades on the recognition chart. The teacher can use special words to describe the team's performance such as science stars, science geniuses, or Einstein's.

APPENDIX VII

LECTURE METHOD LESSON PLAN

Lesson One

Class: SSII

Time: 40Minutes

Topic: Mitosis

Instructional Objectives:

At the end of this lesson, students should be able

- to define mitosis
- identify the various stages of mitosis
- Outline the significance of mitosis

Step 1 Introduction

The teacher introduces the topic. He gives background information such as the definition of osmosis, where osmosis takes place

Step 2: Stages of osmosis

The teacher here with the aid of chalk and the chalk board describe the various stages of mitosis

Step 3: Significance of Mitosis

Using relevant examples, the teacher outlined the significance of mitosis

Evaluation

The teacher evaluates the students by asking the following questions:

- What is osmosis
- Describe the metaphase stage of mitosis
- List four significance of mitosis in life

Lesson Two

Class: SSII

Time: 40Minutes

Topic: Meiosis

Instructional Objectives:

At the end of this lesson, students should be able to

- Define Meiosis
- State briefly the differentiate between Mitosis and meiosis
- State the significance of meiosis in living organism

Step 1(Introduction)

Here the teacher briefly define meiosis and differentiate it from mitosis.

Step 2:

Different stages of meiosis will be highlighted using the chalk and the chalk board

Step 3

The significance of meiosis in living thing will be outlined

Evaluation

- Briefly define meiosis
- State briefly three differences between meiosis and mitosis
- List four significance of meiosis in living organism

Lesson 3

Class: SSII

Time: 40Minutes

Topic: Gene and its Structure

Instructional Objectives: At the end of this lesson, students should be able to

- Define a gene
- Describe the position of the gene in the chromosome
- Describe the structure

Introduction

A Geneis define as the factor that determine character. It is occur in pairs in all cells except in gamete.

Step1

The location of the gene in the chromosome and its locus position will be described with the aid of a chalk and a chalk board.

Step 2

The helical structure of DNA and the bases will be highlighted

Evaluation

- Define a gene
- Where are genes located?
- In term of number, how will you differentiate a somatic cell and a gametic cell?

Lesson 4

Class: SSII

Time: 40Minutes

Topic: Chromosome and its Structure

Instructional Objectives: At the end of this lesson, students should be able to

- Define Chromosome
- Describe Homologous Chromosome
- Describe Haploid and Diploid state

Step 1(Introduction)

The definition and the description of chromosome will be outlined. The location of chromosome in the cell will be highlighted using the chalk and the chalkboard.

Step 1

With aid of chalk and chalkboard, Homologous chromosome will be explain by the teacher as chromosome

Step 2

I reference to the chromosome number, the teacher describe haploid and diploid

Evaluation

- Define a chromosome
- Describe a homologous chromosome
- Differentiate between haploid and diploid cell

Lesson 5

Class: SSII

Time: 40Minutes

Topic: Monohybrid Crossing

Instructional Objectives: At the end of this lesson, students should be able to

- Define a monohybrid crossing
- Perform some monohybrid crossing stating the F1 and the F2 generation
- Describe a phenotype and genotype

Step 1(Introduction)

The teacher briefly defines and describe monohybrid crossing using relevant example

Step 2

Using the chalk and the chalk board, the teacher demonstrates a simple monohybrid crossing. The steps in arriving at the F1 and F2 generation will be outlined

Step 3

In reference to the offspring in F1 and F2 generation, the teacher describe the concept of phenotype and a genotype

Evaluation

- What is monohybrid crossing?
- Who can give an example of monohybrid crossing?
- Differentiate between a phenotype and a genotype

Lesson Six

Class: SSII

Time: 40Minutes

Topic: Monohybrid Crossing II

Instructional Objectives: At the end of this lesson, students should be able to

- Construct a Punnet Square
- Define a Dominant and a Recessive Gene
- Describe a test cross

Step 1(Introduction)

The teacher briefly review the concept ofmonohybrid crossing using relevant example

Step 2.

With the aid of the Marker and the Marker board .The teacher the punnet square was described as an alternative method of showing genetic grossing

Step 3

Using the Marker and the Marker board, the teacher describes a Dominant Gene and a Recessive Gene.

Step 4

The teacher with the aid of a Marker and the Marker board, define test cross and demonstrate to the student how organism are test cross

Evaluation

- What is a Test Crossing?
- How can you Define A Dominant Gene
- Why do we use Test Crossing

APPENDIX VIII

GENETIC PERFORMANCE TEST MARKING SCHEME

1. B 13. C 23.B

2. D 14. A 24.C

3. D15. B 25. C

4. D16.C

5. B17.C

6. A18.C

7. C19.C

8. C20.D

9. B21.C

10. A22.B

11. B22. B

12. C