EFFECTS OF PEER COLLABORATION AND SELF-REGULATED LEARNING STRATEGIES ON ACHIEVEMENT IN BASIC SCIENCE AND TECHNOLOGY AMONG UPPER BASIC TWO STUDENTS IN BENUE STATE

BY

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CERTIFICATION

We certify that this thesis titled: Effects of Peer Collaboration and Self-Regulated Learning Strategies on achievement in basic science among upper basic two students has been duly presented by JIRGBA MBAKOHOL CHRISTY BSU/CUT/PhD/09/3146 of the Department of Curriculum and Teaching, Faculty of Education, Benue State University, Makurdi and has been approved by the examiners

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DEDICATION

This thesis is dedicated to God Almighty for His guidance and protection during this study and always.

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ABSTRACT

This study examined the effects of peer collaboration and self-regulated learning strategies on achievement in basic science among Upper Basic 2 students in Makurdi Local Government Area of Benue state. The study employed a non-equivalent group pre-test-post-test quasi experimental design. The population of the study was 638 Upper Basic school levels 1-3. The sample for this study consisted of 128 students from six co-educational schools within Makurdi Local Government Area of Benue State. Five research questions and six hypotheses guided the study. The instrument used for data collection was Basic Science Achievement Test (BSAT). Kuder-Richardson (K-R, 20) formula was used to determine the reliability coefficient of BSAT which was found to be 0.99. Descriptive statistics of means and standard deviation were used to answer all the research questions and inferential statistics of Analysis of Covariance (ANCOVA) was used to test all the hypotheses at 0.05 significance level. The result of the study showed that, Peer Collaboration Learning Strategy enhanced students' achievement in Basic Science better than Demonstration method. There was a significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using demonstration method ($F_{1, 86} = 8.01$, $p = 0.01 < 0.05$), Demonstration method enhanced students' achievement in Basic Science better than self regulated Strategy. However, there is no significant difference between the mean achievement scores of students taught basic science using self regulated learning strategy and those taught using Demonstration method ($F_{1, 81} = 0.88$, $p = 0.35 > 0.05$),Peer Collaboration Strategy enhanced students' achievement in Basic Science better than self regulated strategy. There was a significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using self-regulated learning strategy ($F_{1, 86} = 8.70$, $p = 0.00 < 0.05$), Peer Collaboration Strategy facilitated achievement better among the male students in Basic science compared with the female students in the same class. However, there was no significant difference between the mean achievement scores of male and female students taught basic science using peer-collaborative learning strategy ($F_{1, 45} = 0.03$, $p = 0.87 > 0.05$), Self-Regulated Learning Strategy enhanced male students' achievement in Basic Science better than the female students in the same class. However there was no significant difference between the mean achievement scores of male and female students taught basic science using self-regulated learning strategy ($F_{1, 40} = 0.20$, $p = 0.66 > 0.05$). There is no significant interaction effect of methods of instruction and gender on students' achievement in basic science ($F_{1, 127} = 0.03$, $p = 0.97 > 0.05$).Based on these findings, it was recommended among other things that, teacher training institutions should use peer collaboration learning strategy as one of the effective strategies to be inculcated in the students teacher training.The school administrators should allow and provide adequately for the basic science teachers to take refresher courses in Peer Collaboration Learning Strategy to enhance students' achievement in basic science.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Science is the study of the natural world based on observation and experimentation, which result to the understanding of what the natural world is all about. Ahmed (2011) viewed science as an attempt to explain natural phenomena in terms of underlying causes in an economical ways as possible preferably using mathematics. Science and technology contribute enormously towards extending the intellectual capability and also in solving many societal problems like quality of life in many areas such as health, nutrition, agriculture, transportation, information and communication (Akpan, 2008). Hence nations all over the world, Nigeria inclusive, are striving to develop technologically and scientifically (Adejoh, Amali &Omaga, 2013). Ali (2004) observed that nations that are deemed to be developed and largely considered as civilized have achieved the status through purposeful and strategic scientific education of their citizen.

Relatively, science educators have received national emphasis on the country's bid to achieve indigenous technological and industrial development through improved methodology, National Policy of Education (FRN, 2004). As a result, national, state and private workshops and seminars have given rise to the development of science curriculum projects, such as the Nigerian Primary Science Project (NPSP), the Nigerian Integrated Science Project (NISP) and the Nigerian Secondary School Science Project (NSSSP). Though, these projects are more than two decades ago, they seem to have made appreciable impact on the teaching of science subjects in Nigeria. These have not only

created a new awareness of science, but have also indicated the need for a radical departure from or modification of such conventional methods of teaching sciences such as inquiry methods modified to guided inquiry method. Basic Science educators are also in this quest, since there is dire need of more effective methods of teaching and learning of science.

In view of the importance of science to the national development, science education curriculum is developed at various levels of education in Nigeria. The science education course at the Basic Education level include basic Science and technology at lower and middle Basic Education(primary1-6), Basic science at upper Basic Education(Junior Secondary School(Upper basic1-3). At the senior secondary school level the subjects include, Biology, Chemistry and Physics, while at the tertiary education level, the following courses are available; Biology education, physic education chemistry education and integrated science among others, Nigerian Educational Research and Development Council (NERDC, 2007).

Basic science and technology recently introduced is new in Nigerian schools, though the curriculum is a further enhancement of that of integrated science. Basic science stresses to beginners the general principles which run through the entire world of science. In effect, teachers who are trained to teach basic science must move away from discriminatory attitude towards any of the science. This means that basic science teachers must be competent in the subject matter so as to eliminate the boundaries and repetition from various sciences such as (biology, chemistry, and physics). The objectives of basic science curriculum include, developing students interest in science and technology, to enable students acquire basic knowledge and skills in science and technology, to enable

students to apply the scientific and technological knowledge and skills to meet societal needs, to enable students to take advantage of the numerous career opportunity offered by science and technology, to enable learners become prepared for further studies in science and technology, Nigerian Educational Research and Development Council (NERDC,2007).

Basic science is the foundation of all sciences and those who pass it with a credit pass at Basic Education Certificate Examination/ Junior School Certificate Examination (BECE or JSCE) are qualified to read sciences at the Senior Secondary School level. This prepares them to advance to other higher and specific courses in science and technology at the tertiary institutions in Nigeria or abroad.

Due to the important role Basic Science plays in the life of a nation and her citizenry, there have been repeated efforts that brought about the changes from Integrated Science at lower school level to Basic Science with a view to arrive at a curriculum that will satisfactorily meet the needs of Nigerians, and as a result there is need for method of instruction that is activity based strategy to improve students achievement in Basic Science.

Despite the relevance of basic science as a foundation course for the sciences and national development, research report by Okebukola (2005), Ajagun(2006) and Adejoh (2012) working separately have lamented the poor performance of science students in Nigeria. According to Ezenwa (2009), the achievement of students in sciences in Nigeria has remained consistently poor. In-fact, a survey of the achievement in Junior Secondary School (JSS) Basic science and technology in Nigeria over the years reveals a discernable

decline. This phenomenon has remained a source of concern to science educators and specifically Basic Science experts (Okeke, 2007).

Anekwe (2008) attributed the problem to inappropriate teaching strategies and non-availability of necessary facilities for the teaching of sciences among other things, in addition to students' socio-economic background and intelligence. As a result, many students have failed to advance in science at the senior secondary school due to their poor performance in the Basic Science subject at the Basic Education Certificate Examination (BECE) or Junior School Certificate Examination (JSCE). Those who scale through into the Senior Secondary Science class perform poorly at their Senior School Certificate Examination (SSCE) examinations due to their poor foundation at the Basic school level. This may occur as a result of inappropriate use of strategies by science teachers (Anekwe, 2008)

The National Policy on Education (FRN,2013) on its implementation, so far ought to have helped reduce this failure trend, there are several factors accounting for the decline in performance such as curricular, implementation, lack of provision of instructional materials and lack of man power. But unfortunately, the trend appears to have continued as indicated by the reports from Benue State Examination Board (BSEB) Makurdi from 2008-2014. The rate at which students pass Basic Science and Mathematics as low compared to other Arts subjects like Social studies, Creative art, PHE, within these years.

The result of BECE has shown that, students' achievement has persistently remained below 50 percent, the implication been that less than half of all students who sat for BECE/JSCE in basic science from 2008 to 2014 failed to obtain the prerequisite

grades to pursue science oriented career at higher educational level. This issue of students' underachievement in basic science has been persistently associated with the kind of instructional methods employed by the teachers and may also be as a result of some difficult concepts such as human systems and some aspects of physics related content in basic science.(See appendix A, P. 104)

On the other hand, Nwosu, (2007), Okeke, (2008) and Azuka (2009), have put the blame for the poor performance in basic science in schools on; the classroom teacher; teacher's professional training in school and on the method of teaching employed. By and large, evidence of their research findings and day-to-day events appear to lay weight to the foregoing claims that teachers are responsible for the under-achievement in science education. Here reference is often made to their methodology used. In the same vein, Nwosu (2007) pointed out that using the conventional method such as, demonstration method, lecture method and discussion methods, the teacher talks most of the time while the students listen passively and watch as the teacher demonstrates and reads about the content. This makes the classroom teaching environment teacher dominated, textbook bond and examination oriented without recognizing the need for the development of science process skills in the students. Science teaching must be done through appropriate strategy which fosters understanding for applicability. Good quality teaching gives rise to functional learning (Jirgba, 2008).

Studies by Zimmerman (2005), O'Donnell (2006), Poellhuber, Chiominne and Karsenti (2008) and Samuelson (2010) reveal that learners' understanding of science concepts is often inadequate or erroneous due to poor methodology leading to non-grasping of concepts and obvious compartmentalization of scientifically valid ideas with

the end result being rote learning. This, the researcher noted as a contributory factor in the poor achievement of students in science examination. Some scholars (Achor, Imoko & Uloko, 2009) have asserted that methods of science instruction including the activity-based strategies seem to be ineffective in terms of students' achievements and require some modifications.

In agreement with these assertions, science educators, Adejoh (2009); Samba & Eriba (2012) have researched into method combination, and modifications that can bring about effective teaching and learning of Basic Science which is the foundation of all sciences at the higher levels. Perhaps, an addition of method combinations such as peer collaboration and Self-regulated Learning Strategy that form literature are scarce in the study area could make for the intended change. The researcher observed that peer learning and self-regulated learning as pedagogical strategies are usually not introduced to students of Basic Science at the Upper basic School classes as the actual teaching method in Makurdi and Benue State at large.

Demonstration method- demonstration means display of something. It is a way of acquiring skills in science because during demonstration method the how to do science is introduced. In demonstration methods teachers utilize when materials to be used in teaching are dangerous or when the materials for teaching are in adequate. During demonstration the students listen, observe and watch keenly and participate less.The teaching of Basic Science appears to have been reduced to a descriptive exercise through the use of conventional demonstration. Considering this kind of background, the study is of the view that, making students to be aware of their role in a collaborative classroom could have a facilitative effect on learning while a teacher acts as a mediator or a

facilitator. Samuelson (2010) observed that, most teachers emphasized demonstration method of teaching science rather than activity based strategies such as peer collaboration, constructivism and self-regulated aspect of teaching science subjects.

Peer collaboration is a method in which 4 or more students work together face-to-face in a classroom setting towards achieving a mutual goal of learning from a particular task (O'Donnell, 2006). Generally, some scholars (Zimmerman, 2008 & Samuelson, 2010) have suggested that peer collaboration is a more effective method of teaching science at the Junior Secondary School level. And it has been approved by many educational researchers for the past decade for its positive role in classroom-based learning, which has been evaluated positively in the outcome of learning among distance educational learners. Poellhuber, Chiominne and Karseti (2008) opined that one way of enabling students to learn and understand science and the process of science is to teach science as peer collaboration and self-regulated learning strategies. Some science educators such as (Keramati, 2010: Wayne, 2013) have come up with different strategies all with the intention to improve teaching and learning of science such as guided enquiry, concept mapping and discovery.

Self-regulatory strategy of cognitive behaviour is considered an important aspect of students learning and academic performance in the classroom context. It includes students meta-cognitive strategies for planning, monitoring, modifying their cognitive ability, students management and control of their efforts on academic tasks, even when there is distraction such as noise making, they still maintain their focus which enable them to perform better (Barak, 2009). Based on this therefore, self-regulated learning

strategy may be useful in this study because it enhance cognitive engagement in learning and this may result in higher level of achievement in Basic science.

This study will utilize behavioural theory perspective on self-regulated learning which is derived largely from the work of Skinner (Mace, 2005). Researcher working within the framework of his operant conditioning theory apply operant principles in diverse settings for example, clinical academic with adults and children with the aim of reducing dysfunctional behaviours and replacing them with more adaptive behaviour (Zimmerman, 2010). Students self-regulate their behaviour by initially deciding which behaviours they will adopt. They can establish discriminative stimuli for their occurrence provide self-instruction as needed and monitor their achievement to determine whether the desired behaviour occurs.

Gender is another relevant issue in the learning of Science and Technology, since the social expectations that prescribe how males and females think, act and feel differs. In Nigeria, as in other countries of the world Science and Technology are usually viewed as male dominant subjects (Ogunkunle, 2009). Girls opt for careers in humanities and social science related careers. Gender differences in science achievement has been the major concern in science education and science educators seek to provide avenues for achieving gender equity for sustainable development.

The performance in the science at both upper basic and senior secondary school levels of education varies across gender. It appears that female students are more scared of the science subjects in which basic science is inclusive at both levels and as a result fewer girls than boys who take the science subjects at the Senior School (SS) level performed poorer at the SSCE than their male counter-parts (Okeke, 2008). Study

comparing performance of boys and girls in the basic science shows that boys perform better than girls in science and technology (Aigbomian, 2006). Ogunkunle (2009) observed that boys perform better than girls in science, technical and mathematics in which basic science is inclusive, when test measures of problem solving skills at the complex cognitive level. He attributed the low achievement of girls to spatial ability and other cognitive disadvantages. On the other hand, Hydea and Mertzb (2009), observed that girls performed better than their male counter-parts in science subjects.

There seems to be an existing gap that needs to be filled by the researcher, which this study aims to achieve, that is, effect of peer collaborated and self-regulated learning strategies on achievement in Basic Science in Nigeria, Benue State, and Makurdi Local Government in particular.

As part of the ongoing search therefore, this study intends to answer the following background question; what kind of method combination or modifications can improve students' achievement in Basic Science? Of course, providing peer collaborative and Self-regulated Learning Strategy to students of varied socio-economic background and gender could go a long way in providing a clue to the answer to the background question.

1.2 Statement of the Problem

Studies on achievement in science subjects among secondary school students show that, there is a relatively steady decline in students' overall performance in sciences especially in external examination in which Basic Education Certificate Examination or Junior School Certificate Examination (BECE/JSCE) is inclusive (Obemeata 2007 cited in Ogbeba, 2009). Obemeata, (2007), blames this observable decline on a number of factors such as, none use of effective methodology for teaching science especially Basic

Science in secondary schools. The continual and unabated poor achievement of students suggests that the situation should no longer be glossed over as carelessness on the part of the students. Secondly this may be as a result of lack of students' interaction in the classroom settings. Thirdly lack of dedication on the part of teachers which have significant effect on their achievement in Basic Science.

It thus becomes imperative that new strategies for revolutionizing the teaching and learning of Basic science must be researched into, more so that available teaching methods do not seem to alleviate this problem of decline in students' achievement. Zimmerman (2004) and Samuelson (2010) were of the opinion that, teaching method where students are able to interact with teachers and peers seem to promote positive cognitive and affective outcomes among students. This explains why peer collaboration and self-regulated strategies are considered for trial in Basic science in this study. There is no evidence to show that studies were carried out in Benue State Education Authority especially in Makurdi Local Government Area and if such findings are gender biased. Therefore, the problem of this study put in question form is, what are the effects of peer collaboration and Self-regulated Learning Strategy on students' achievement in Basic Science?

1.3 Purpose of the Study

The purpose of this study was to ascertain the effects of peer collaboration and self-regulated learning strategies in facilitating achievement in Basic Science among Junior Secondary School students. The specific objectives of the study subsumed under this purpose include to:

i. Determine the effects of peer-collaboration learning strategy on students' achievement in basic science in Makurdi Local Government Area

ii. Determine the effects of Self-regulated Learning Strategy on students' achievement in Basic science in Makurdi Local Government Area

iii. Investigate the difference in the mean achievement scores of students taught using peer-collaboration and self-regulated learning strategies in upper basic two (UB2)in Makurdi Local Government Area

iv. Determine the effects of peer-collaborative learning strategy on the achievement scores of male and female students in basic science in Makurdi Local Government Area

v. Determine the effects of Self-regulated Learning Strategy on the achievement scores of male and female students in basic science in Makurdi Local Government Area

1.4 Research Questions

In order to provide direction and focus to the study, the following research questions guided the study.

i. What is the mean achievement scores of students taught basic science using Peer collaboration and those taught using Demonstration method

ii. What is the mean achievement scores of students taught basic science using Self-regulated learning strategy and those taught using Demonstration method

iii. What is the mean difference in the achievement scores of students taught with peer-collaborative learning strategy and those taught using Self-regulated Learning Strategy?

iv. What is the difference in the mean achievement scores between male and female students taught basic science with peer-collaborative learning strategy?

v. What is the difference in the mean achievement scores between male and female students taught basic science using self-regulated learning strategy?

1.5 Hypotheses

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

H_{O1}: There is no significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using demonstration method.

H_{O2}: There is no significant difference between the mean achievement scores of students taught basic science using Self-regulated Learning Strategy and those taught using demonstration method.

H_{O3}: There is no significant difference between the mean achievement scores of students taught basic science using peer collaboration and those taught using self-regulated learning strategies.

H_{O4}: There is no significant difference between the mean achievement of male and female students taught basic science using peer collaboration learning strategy.

H_{O5}: There is no significant difference between the mean achievement of male and female students taught basic science using Self-regulated Learning Strategy.

H_{O6}: There is no significant interaction effect of method of instruction and gender on the mean achievement scores of students in Basic Science.

1.6 Significance of the Study

The utility value of this study becomes obvious when we appreciate the place of sound instructional methodology and strategy in the teaching-learning processes. Therefore, in view of the public outcry over the students' poor achievement in public

examination and considering that the poor achievements could be traceable to poor methodologies. The findings of this study maybe beneficial to the following; the students, Basic Science teachers, Educational Institutions such as Colleges of Education, Faculties of Education, School Administrators, Science Educators, Curriculum Planners and Developers, Benue State Policy makers, to Educational theory and practice in the field of science, the Nation and incoming researchers.

The findings of this study may be useful to Basic science students since peer collaboration and self-regulative learning strategies place students in problem solving situation and surrounding them with appropriate materials thereby enabling them to interact with instructional materials and with one another. This makes students active learners rather than passive learners. When students are actively involved in the teaching-learning process in science, they acquire science process skills as well as develop their formal reasoning ability since the students are involved in abstract thinking which is characteristic of their age, hence this can enhance their performance. Thus giving them opportunity to select or read science subjects at the senior secondary level

The findings of this study may encourage basic science teachers to use peer collaboration and self-regulated learning as an instructional strategy in the teaching and learning situation if found suitable in meeting the students need to achieve higher scores in basic science. The result of this study may enable teachers to shift their emphasis from the conventional methods of teaching basic Science to the strategy that has been investigated.

The implication of this is that basic science teachers could be enriched with an alternative instructional strategy that may complement the traditional teaching method,

which may help them to teach their students to achieve higher scores in basic science. Again, the success of the students will equally boost the morale of the teachers to teach effectively. It would also reduce abstractness in the subject and make their teaching easier.

The findings of this study could also be of benefit to educational institutions particularly the colleges of education and faculties of education in Nigerian universities to improve their method of instruction. This is because a great deal of research effort in science education has been directed at strategy or techniques that will enhance the teaching and learning of science in general and basic science in particular. It may also be beneficial to the teacher who becomes a facilitator of learning rather than the dispenser of knowledge, thereby reducing the enormous task on him/her.

In addition, school administrators may find the findings of this study useful in their desires to improve academic standards of their schools by employing this recent and effective method of instruction. It is also useful to science educators and curriculum planners /developers since the new science curriculum in Nigeria stresses the importance of acquisition of the science process skills in all levels of educational system. Similarly, the National Policy on Education (FRN, 2004) also demands as part of its aims and objectives in the acquisition of appropriate learning strategies, abilities and competences (mental and physical) as equipment for the individual to live and contribute to the development of the society.

The Benue State policy makers in the development of science curriculum may use the findings of this study as an empirical basis to include the two pedagogical strategies (peer collaboration and self-regulated learning) to foster the learning of science at secondary school level (especially Basic Science at upper basic level. This may foster the

learning of science and technology as this has been incorporated successfully in the learning of technology-based courses.

Within the field of science education, the findings from this study may add to the pool of available data in the area of teaching strategies for effective teaching-learning process. Therefore, this study may be significant to science education researchers as well as educational theory and practice in the field of science. Also it may benefit the nation because it would enhance students' performance and boost the nation's development in science and technology. It is also expected that the finding would contribute to incoming researchers as empirical evidence in the teaching and learning of basic science. Finally, this research work may be published and made available in conferences, workshops, seminars, libraries and the internet.

1.7 Scope of the Study

This work was delimited to the effect of peer collaboration and Self-regulated Learning Strategy on students' achievement in Basic Science. The study was also delimited to upper basic 2 (UB2) in Makurdi Local Government Area of Benue State The choice of upper basic 2 is because students at this level had experienced the teaching and learning of basic science and technology for a duration of 2 years. This is believed to have provided an in-depth knowledge about the basic science and technology content. Upper basic one (UB1) students are in their first year and have no in-depth knowledge about the content yet. While upper basic three (UB3) were preparing for their external examinations (BECE) at the time of carrying out this research. However the study was delimitated to basic science only. The topics considered are metabolism in the human digestive system, drug abuse, elements, compounds and mixtures and disease vectors.

These topics were chosen because, of the past records in-terms of their performance, difficult concepts and the abstract nature of the concepts. This topics formed part of basic science upper basic 2 (UB2)content/syllabus in the curriculum developed. However the researcher focus only on Basic science

1.8 Operational Definition of Terms

The following terms are defined on how they are used in this study.

Peer Collaboration: This is a peer-learning situation in which students are put into groups of four's and giving a basic science task, they share ideas/thoughts both cognitive psychomotor and affective to solve a problem.

Self-regulated Learning: Is self-generated thoughts, feelings and actions that are systematically oriented toward the achievement of students' own goals and it does not necessarily need external motivation/re-enforcement for example, planning, goal setting, and strategy implementation, summarizing and monitoring one's progress which requires learner's intrinsic behaviour.

Achievement: This is the upper basic science students' means scores and rating in the Basic Science Achievement Test (BSAT),after their exposure to peer collaboration, self-regulated and conventional demonstrative teaching strategies.

Demonstration Method: as used in this study it involves manipulation of scientific equipment or display of instructional materials in other to illustrate basic science concepts/principles.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

In this chapter, literature relevant to the study is presented and discussed under the following subheadings, theoretical framework, conceptual framework, empirical studies and summary.

2.2 Theoretical Framework

This study is anchored on the learning theories of, Jean Piaget's (1957) theory of intellectual development, Jerome Bruner's (1960) learning by discovery and Vygotsky's (1978) socio-cultural theory.

a. Piaget (1957) Theory of Cognitive Development.

Piaget(1957) propounded a theory of cognitive development which has impacted on educational practice till date. Piaget was particularly concerned with the study of growth of knowledge within the individual. Initially, he studied the intellectual growth of infants from the first day of life. Piaget later investigated the importance of language and logic in cognitive development as well as the development of abstract and scientific reasoning. The stage of intellectual development as advanced by Piaget are, (i) the sensory motor stage (0-2yrs),(ii) the pre-operational stage(2-7yrs)(iii) the concrete operational stage(7-11 yrs.) and(iv) the formal operational stage(11-15yrs). The researcher is concern on the formal operational stage (11-15yrs) which is relevant to the level of the learner (UBS) under investigation

This stage (formal operational stage) is relevant to Upper basic school level who are already in their teenage / adolescent stage. At this stage, the learner is advanced in his

thinking and capable of engaging in abstract thought and is able to think logically with abstractions or feelings. He/she engages in prepositional thinking and manipulation of ideas without necessarily manipulating objects. He retains his previous attainment of concrete operational level and is able to reason not simply with concrete preposition but with verbal preposition.

The prepositional thinking helps the development of hypothetical procedures which are vital for the understanding of mathematics and science. He/she can transfer reasoning pattern from one content to another, engaging inductive (simple to complex) and deductive (general to specific) reasoning. The child thinks about the past, present and is able to project into future event. This therefore, informed the choice of the Upper Basic students for this study. He becomes more introspective and self-critical and analysed value and behaviour. This is in line with Self-regulated Learning Strategy and social interaction established in this stage which is characteristic of peer collaboration learning strategy.

Piaget sees mental development as a product of interaction between the child's internal mental process and his external environment. Piaget strongly believed that experience plays a significant role in learning. It is the learners' interaction with the environment that brings about the development of concept that enables the child understands and organizes a stable world. According to Piaget, what accounts for cognitive growth is experienced gained through socialization and activities aimed at exploring the environment.

Piaget's theory of cognitive development has a lot of implications for science teaching and learning. The science teacher has to find out when a particular subject

matter should be taught, what content is most relevant at that material time and how it may be presented to the learner. That is to say, science (basic science) curriculum and instructional methods must match with the learner's level of cognitive ability/ development.

This cognitive ability will help the teacher identify the reasoning patterns and level of thinking of the learner, thereby helping him to choose the right type of instructional technique that will enhance the learner's intellectual ability. Also what the learner already knows needs to be determined to ensure that, he is ready for new knowledge that will be presented to him. Therefore, learning material should be organised in such a way that the new knowledge is slightly more complex than the existing knowledge in the learner cognitive structure. This will enhance cognitive growth in the learner.

The strategies of teaching basic science should be such that will evoke and sustain interest in the learner , as well as challenge his reasoning ability or thought process to enhance cognitive growth and advance his thinking ability. The method of teaching and learning of Basic science should be learner-centred and activity based/problem-solving-approach so as to engage the learners in appropriate manipulative skills which according to Piaget children learn more by doing, since cognitive growth at any point in time depends on activity. Therefore engaging students in activity provides the opportunity for social interaction which is a characteristic of formal operational stage. Studies also show that social interaction promotes performance in science. Piaget theory is fundamental to self-regulated and peer collaboration learning strategies in the teaching and learning of basic science in upper basic school level because of its emphasis on learners interactions

and selection of appropriate instructional methodology and curriculum content that will match with the learner level of cognitive development.

b) Bruner's (1960) Theory of Learning by Discovery

This theory centres on learning through discovery activities performed by the learners. The theorist strongly feels that the learner should obtain knowledge by him/herself through the use of materials and learners mental processes. Bruner maintains that learning is best promoted when learners are able to figure things out themselves. In other words, the theory advocates a learning situation in which learners become "detectives". One is able to do this either because his/her cognitive structure is already turned to absorb new information in which case there is familiarity and the new set is simply assimilated to accommodate the new learning .

Bruner contends that there are two forms of discovery learning namely: Assimilation and Accommodation, he deliberately builds potential incongruities into the learning materials which, will also cause dis-equilibrium, he eventually makes some discoveries through the process of cognitive restructuring by either assimilating the learning material or accommodating it into his existing knowledge.

Bruner's theory has wide implications for the teaching and learning of Basic science in the sense that basic science teachers should, in the process of instruction, deliberately create problem for the student with a purpose that they will learn the basic science as they struggle with the problem. It implies that learners must occupy themselves with exploration to be able to discover their environment. This theory emphasized learner-centred activity based oriented approach. This theory holds unto some promise for a number of desirable educational dividends such as generating self-

confidence, self-monitoring, self-judgment, and self-evaluation, and intellectual excitement, motivation for sustained problem-solving and creative thinking. Greater emphasis is placed on doing rather than telling and learners learn by social interaction, share ideas and experiences, talk freely, discuss their difference and what they have arrived at an agreeable terms.

This theory is in line with the study under investigation which is the effect of peer collaboration and self-regulated learning strategies on achievement, as it relates to some aspects of this theory especially in the area of social interaction, sharing of ideas / experience, problem-solving-approach. Also peer collaboration learning instructional strategy involves placing students in small groups that enable them to interact, discuss, share ideas, ask questions and work through materials together and generating self-confidence, self-monitoring, self-evaluation, intellectual excitement, motivation for sustained problem-solving and creative thinking as in the case of Self-regulated Learning Strategy. This helps learners recognise new facts among group concepts as well as refine the understanding of existing relationship as they work together.

However, despite the intellectual attractions of the discovery learning techniques, there is no sufficient time and material for students to discover everything they need to know in science discipline, hence the room for good expository teaching in the schools. Therefore , there is a gap needed to be filled in which the researcher is of the view that carrying out research on peer collaboration and self-regulated learning strategies will bridge the gap leading to most effective teaching and learning of science especially basic science at upper basic level

c) Vygotsky's (1978) Socio-Cultural Theory

Vygotsky (1978) postulated his socio-cultural theory which looks at the role culture and social interaction play on the cognitive development of children. The theorist feels social interaction influences cognitive development and observes that as the child interacts with his social environment, he/she acquires knowledge which becomes the content of his thinking. Through this interaction, the child acquires the means of thinking from the culture he lives, which to Vygotsky are the cognitive tools needed for development. These tools include cultural history, social content and language. In other words we learn "what and how to think" from our social environment or culture.

The theory advocates for collaboration/ co-operative learning as a means of using others to help us learn. Vygotsky also support a discovery model of learning. According to his ideas, teachers should guide, extend and challenge the cognitive development of learners. In his opinion, teachers do not only help learners to develop their cognitive abilities, but also those of their peers. Collaborative/co-operation learning to him helps to encourage and help each learner learn new materials.

Vygotsky believes there should be no room for traditional teacher-centred approach to education, and he did not see the learner as one who should construct knowledge by himself rather the learning process should be a shared responsibility between the learner and the teacher. In other words Vygotsky saw intellectual development as dialectical process, where a learner learns through problem solving experience with a facilitator, either in the form of a teacher, a parent, peer and or an adult. However the theory does not call for cognitive acceleration, rather, it advocates a slow,

careful sequencing of instruction. The theory does not expect teacher to do the cognitive work on behalf of the learner rather it suggests a situation in which the teacher presents a problem to be solved and is willing to engage the learner in activities and meaningful learning. The teacher therefore acts as facilitator of knowledge, rather than leaving learner to discover on their own.

The theory calls for active teaching and learning through engagement of the learner on meaningful activities. The theory emphasizes comprehension, for any learning to take place effectively. To him without comprehension the learning and teaching is useless and fruitless as it cannot result in the retention of information. Vygotsky theory recognises the learner as being active and interactive just like theory of Piaget(1957) and as such, relevant to the study to a large extent. In the sense that, it pays much attention to the social and cultural influence on the learner's cognitive development than on the physical (biological) maturation of the learner which plays a significant role in cognitive development. Unlike Piaget, Vygotsky did not see the learner as one relegated to an isolated environment to build his/her own conceptual tools all alone, instead the learners' cognition are shared in a reflective discussion with others who help to provide perspective for cognitive growth. Vygotsky theory therefore forms a base on which this study can be anchored.

2.3 Conceptual Framework

This study hinged on some conceptual framework which are in consonance with the problem under investigation, these are as follows; strategies for teaching basic science, traditional teaching method, gender and learning of science, peer collaboration learning, characteristics of a collaborative classroom, teachers' role in collaborative

classroom, students' role in a collaborative classroom, goal setting and concept of self-regulated learning.

a. Strategies for Teaching Basic Science

The success of any school programme depends to a large extent on what the teacher does with his/her students Azuka (2009). It is generally believed that the instructional methods adopted by basic science teachers can promote effective basic science teaching in classroom. Due to the importance of instructional methods/ strategies adapted to students' achievement of basic science content, the National Science Curriculum (NSC) (2005) recommended the following instructional methods to be used in teaching and learning of basic science for the achievement of the stated objectives. These include: field trip, guided discovery / inquiry and laboratory methods.

Despite this recommendation, available evidence by Azuka (2009) revealed that the teaching strategies employed in teaching science are not different from the traditional methods. Azuka (2009) noted that several science teachers in our secondary schools still teach science using the expository methods. Anekwe (2008) have found not only to be ineffective in teaching science but also hinder growth of students of reasoning and problem solving skills. Nwosu (2007) opined that science teachers indicated to an acceptable extent the use of inquiry strategy in teaching science for the acquisition of science process skills, their inability however to state correctly all the science process skills leaves one in doubt on how they teach for the acquisition of these required skills.

Therefore, there is need for a serious teaching strategy that could be adopted to give learners opportunity to make meaning out of learning materials. This seems to give

credence to peer collaboration and self-regulated learning strategies which may be the most effective learning strategies that can promote learning meaningfully.

b. Teaching Method

Teaching method appears to be over stressed by science teachers; basic science inclusive. Ada (2006) stressed that, using traditional teaching method, the teacher talks most of the time, while the student listen, passively to the teacher and read about the content thereby making the classroom-teaching environment teacher dominated, didactic, textbook bound and examination-oriented without recognizing the level of understanding among the students.

Demonstration is one of the methods of teaching basic science which involves manipulating scientific equipment in order to present or illustrate scientific concepts or principles in a way that the students are directly involved in the teaching-learning processes (Jirgba, 2004).According to her demonstration may also be regarded as a display of instructional material which involves illustrating of techniques or performing an experiment which is difficult, dangerous or expensive for individual student use. In this case, the students are shown the activity in front of the class. It could be done by the teacher with the assistance of some students if need be.

As a teaching technique, demonstration facilitates learning by allowing the teacher to guide and channel students thinking towards intended learning outcome and permit students to observe activities without participation. In this instance students may not acquire the desirable skills and as a result reduce their understanding and hence a

feeling of not been involved in the teaching and learning situation. Demonstration could be teacher centred where most (Ogologo & Wagbara, 2013).

To buttress this saying, Timberlake (2011) pointed out that the method of teaching employed by the teachers in implementing instructional objectives have some effect on students achievement and that the success of any schools programme depends to a large extent on what the teacher and the students do in the classroom. This means that basic science teaching requires pedagogical strategies that will provide a shift in focus from content to process, reduce memorization of concepts, facts and promote meaningful learning.

c. Gender and Learning of Science

Gender of students has also been identified as one of the factor with causal influence on students' achievement. Yang and Chen (2010) observed that girls out performed boys in science achievement. However, Abe(2009) revealed that, girls show lower confidence in their ability to learn Science and mathematics than boys. Reports by Council for Exceptional Children (CEC) (2011) also revealed that boys and girls learn differently, that girls adjust better to school structure excelling in verbal skills where boys excel spatial learning maintaining advantage in science. Ogunkunle (2009) observed that boys perform better than girls in science technical and mathematics in which basic science is inclusive when testing measures of problem solving skills at the complex cognitive level. They attribute the low achievement of girls' spatial ability and other cognitive disadvantage. Hydea and Mertzb (2009) observed that girls performed better than their male counter-part, the reason may be that they might have roots in the choice

of instructional strategies and attitudes towards the teaching and learning of science, parental, teachers as well as career guidance influences. Ariyo (2011)however found out that gender had no effect on students' academic achievement in- view of these development, Wael (2014) observed that investigation on gender difference in proficiencies and skills have a long history, but there is still need for further investigation.

d. Peer Collaboration Learning Strategy

The concept of peer collaboration goes by various appellations such as peer learning (O'Donnell, 2006), collaborative learning, cooperative learning (Slavin2007) and peer tutoring (Samuelson, 2010). Peer collaboration is the term used to refer to peer-learning situations in which students work together, face-to-face, in a classroom context toward a shared understanding called convergence O'Donnel (2006) describe peer learning as a variety of teaching strategies that involve students working together in pairs or small groups to accomplish a mutual educational goal or task. It is a peer-learning situation as one in which "two or more people learn, or attempt to learn something, together". This definition gives room for various ways in which to operationally define 'more people', 'learn something', and 'together'. For instance, under this definition, peer learning could include a description of a pair of students working together on a mutual task face-to-face for one or two class periods (Johnson &Johnson, 2009). This situation can be more specifically described by the term peer collaboration, or collaborative learning.

Slavin (2007) stressed that, peer collaborative learning has its positive role in class-room learning. He identified the supportive characteristics of a collaborative

classroom for effective learning, the peculiar roles teachers play in such learning situation as well as the roles of students in a collaborative classroom.

i. Characteristics of a Collaborative Classroom

According to Winters (2009), collaborative classrooms have four general characteristics. These include shared knowledge among teachers and students, shared authority among teachers and students, teachers as mediators, and heterogeneous grouping of students.

Shared knowledge among teachers and students: In traditional classrooms, the dominant metaphor for teaching is the teacher as information giver; knowledge flows only one way from teacher to students. In contrast, the metaphor for collaborative classrooms is shared knowledge. The teacher has vital knowledge about content, skills, and instruction, and still provides that information to students. However, collaborative teachers also value and build upon the knowledge, personal experiences, language, strategies, and culture that students bring to the learning situation (Winters, 2009).

Winters (2009) considers a lesson on insect-eating plants, for example. Few students, and perhaps few teachers, are likely to have direct knowledge about such plants. Thus, when those students who do have relevant experiences are given an opportunity to share them, the whole class is enriched. Moreover, when students see that their experiences and knowledge are valued, they are motivated to listen and learn in new ways, and they are more likely to make important connections between their own learning and school learning, they become empowered.

In addition, complex thinking about difficult problems, such as world hunger, begs for multiple ideas about causes, implications and potential solutions. In fact, nearly all of the new curricular goals are of this nature, for example, mathematical problem-solving are new requirements to teach topics such as Acquired Immune Deficiency Syndrome (AIDS). They require multiple ways to represent and solve problems and many perspectives on issues.

Shared authority among teachers and students**:** In collaborative classrooms, teachers share authority with students in very specific ways. In most traditional classrooms, the teacher is largely responsible for setting goals, designing learning tasks and assessing what is learned.

Collaborative teachers differ in that they invite students to set specific goals within the framework of what is being taught, provide options for activities and assignments that capture different students' interests and goals, and encourage students to assess what they learn. Collaborative teachers encourage students to make use of their own knowledge, ensure that students share their knowledge and their learning strategies, treat each other respectfully, and focus on high levels of understanding. They help students listen to diverse opinions, support knowledge claims with evidence, engage in critical and creative thinking, and participate in open and meaningful dialogue.

Suppose, for example, the students have just read a chapter on colonial America and are required to prepare a product on the topic. While a more traditional teacher might ask all students to write a ten-page essay, the collaborative teacher might ask students to define the product themselves. Some could plan a videotape; some could dramatize events in colonial America; others could investigate original sources that support or do

not support the textbook chapter and draw comparisons among them; and some could write a ten-page paper. The point here is twofold: (a) students have opportunities to ask and investigate questions of personal interest, and (b) they have a voice in the decision-making process. These opportunities are essential for both self-regulated learning and motivation (Zimmerman, 2008).

Teachers as mediators: Knowledge and authority are shared among teachers and students, the role of the teacher increasingly emphasizes mediated learning. Successful mediation helps students connect new information to their experiences and to learning in other areas, helps students figure out what to do when they are stumped, and helps them learn how to learn. Above all, the teacher as mediator adjusts the level of information and support so as to maximize the ability to take responsibility for learning. This characteristic of collaborative classrooms is so important.

Heterogeneous groupings of students: The perspectives, experiences and backgrounds of all students are important for enriching learning in the classroom. As learning beyond the classroom increasingly requires understanding diverse perspectives, it is essential to provide students opportunities to do this in multiple contexts in schools. In collaborative classrooms where students are engaged in a thinking curriculum, everyone learns from everyone else, and no student is deprived of this opportunity for making contributions and appreciating the contributions of others.

According to Winters (2009), a critical characteristic of collaborative classrooms is that students are not segregated according to supposed ability, achievement, interests, or any other characteristic. Segregation seriously weakens collaborative learning and impoverishes the classroom by depriving all students of opportunities to learn from and

with each other. Students might label unsuccessful in a traditional classroom learn from "brighter" students, but, more importantly, the so-called brighter students have just as much to learn from their more average peers. Teachers beginning to teach collaboratively often express delight when they observe the insights revealed by their supposedly weaker students.

Thus, shared knowledge and authority, mediated learning, and heterogeneous groups of students are essential characteristics of collaborative classrooms. These characteristics, which are elaborated below, necessitate new roles for teachers and students that lead to interactions different from those in more traditional classrooms.

ii. Teachers' Role in a Collaborative Classroom

Teachers' roles in learning situations such as the classroom are the mediation of learning through dialogue and collaboration. While mediation has been defined in different ways by some scholars, (Aydin 2011; Keramati, 2010). Winters (2009), defined mediation as facilitating, modelling and coaching. These behaviours, engaged in by teachers from time to time drive instruction in collaborative classrooms, and have specific purposes in collaborative context, as outlined in the following functions:

Facilitator: Facilitating involves creating new environment and activities for linking new information to prior knowledge, providing opportunities for collaborative work and problem-solving and offering students' multiplicity of authentic learning tasks.

Ways Teacher Facilitates Collaborative Learning**:** This may first involve attention to the physical environment. For example, teachers move desks so that all students can see each other, thus establishing a setting that promotes true discussion. Teacher may also wish to move their desks from the front of the room to a less prominent

space. Additionally, teachers may structure the resources in the classroom to provide a diversity of genres and perspectives, to use and build upon cultural artifacts from the students' homes and communities, and to organize various learning activities. Thus, a collaborative classroom often has a multiplicity of projects or activity centers using everyday objects for representing numerical information in meaningful ways and for conducting experiments that solve real problems. These classrooms also boost a rich variety of magazines; journals, newspapers, audiotapes, and videos which allow students to experience and use diverse media for communicating ideas (Poellhuber, Chiominne & Karsenti, 2008).

According to them (Poellhuber, Chiominne & Karsenti, 2008).Facilitating in collaborative classrooms also involves learner inside the classroom, who are organized into heterogeneous groups with roles such as team leader, encourager, reseller recorder, and spokesperson. Additionally, collaborative teachers work to involve parents and community members. Examples are: a workshop centre in New York invites parents to come and experience the thinking processes involved in conducting experiments using everyday objects so that they can provide such learning experiences at home; teachers in Tucson involve parents and the community in academic tasks their students engage in and rural students in Colorado perform community services such as producing a local newspaper.

Another way that teachers facilitate collaborative learning is to establish classrooms with diverse and flexible social structures that promote the sort of classroom behaviour they deem appropriate for communication and collaboration among students. These structures are rules and standards of behaviours, fulfilling several functions in

group interaction, and influencing group attitudes. Particular rules depend, of course, on the classroom context. Thus, teachers often develop them collaboratively with students and review or change them as needed. For Examples roles are assigned to all members and they have a chance to participate, valuing others' comments, and arguing against (or for) ideas rather than people. Examples of group functions are asking for information, clarifying, summarizing, encouraging, and relieving tension. To facilitate high quality group interaction, teachers may need to teach and students may need to practise rules and functions for group interaction.

Teachers facilitate collaborative learning by creating learning tasks that encourage diversity, but which aim at high standards of performance for all students. These tasks involve students in high-level thought processes such as decision making and problem solving that are best accomplished in collaboration. These tasks enable students to make connections to real-world objects, events, and situations in their own and an expanded world, and tap their diverse perspectives and experiences (Winters, Greene & Costich, 2008).

Model-According to Cleary, Zimmerman and Keating (2006), Modelling has been emphasized by many local and state guidelines as sharing one's thinking and demonstrating or explaining something. However, in collaborative classrooms, modelling serves to share with students not only what one is thinking about the content to be learned, but also the process of communication and collaborative learning. Modelling may involve thinking aloud (sharing thoughts about something) or demonstrating (showing students how to do something in a step-by-step fashion).

In terms of content, teachers might verbalize the thinking processes they use to make a prediction about a scientific experiment, to summarize ideas in a passage, to figure out the meaning of an unfamiliar word, to represent and solve a problem, to organize complicated information, and so on. Just as important, they would also think aloud about their doubts and uncertainties. This type of metacognitive thinking and thinking aloud when things do not go smoothly is invaluable in helping students understand that learning requires effort and is often difficult for people.

With respect to group process, teachers may share their thinking about the various roles, rules, and relationships in collaborative classrooms. Consider leadership, for example. A teacher might model what he/she thinks about such questions as how to manage the group's time or how to achieve consensus. Similarly, showing students how to think through tough group situations and problems of communication is as invaluable as modelling how to plan an approach to an academic problem, monitoring its progress, and assessing what was learned (Samuelson, 2010)

One of the major challenges faced in mediating learning is to determine when it is appropriate to model by thinking aloud and when it is useful to model by demonstrating. If a teacher is certain that students have little experience with, say, a mathematical procedure, then it may be appropriate to demonstrate it before students engage in a learning task (this is not to say that the teacher assumes or states that there is only one way to perform the procedure. It is also important to allow for individual variations in application). If, on the other hand, the teacher believes students can come up with the procedure themselves, then he or she might ask the students to model how they solved the problem; alternatively the teacher could give students hints or cues.

Coach*:* coaching involves giving hints or cues, providing feedback, redirecting students' efforts, and helping them use a strategy. A major principle of coaching is to provide the right amount of help when students need it – neither too much nor too little so that students retain as much responsibility as possible for their own learning (Winters & Azevedo, 2008).

In the same vein, Samuelson (2010) gave an example of a collaborative group of junior high students worked on the economic development of several nations. They accumulated a lot of information about the countries and decided that the best way to present it was to compare the countries. But they were studies as to how to organize the information so that they could write about it in a paper, the product they chose to produce. Their teacher hinted that they use a matrix – a graphic organizer they had learned – to organize their information. When the group finished the matrix, the teacher gave them feedback. In so doing, he did not tell them it was right or wrong, but asked questions that helped them verbalize their reasons for completing the matrix as they did. The principle the teacher followed was to coach enough so that students could continue to learn by drawing on the ideas of other group members.

iii Students Roles in a Collaborative Classroom

According to Samuelson (2010) students also assume new roles in the collaborative classroom. Their major roles are collaborators and active participators. It is useful to think how these new roles influence the processes and activities students conduct before, during, and after learning. For example, before learning, students set goals and plan learning tasks; during learning, they work together to accomplish tasks

and monitor their progress; and after learning, they assess their performance and plan for future learning. As mediator, the teacher helps students fulfil their new roles such as:

Goal setting – student prepare for learning by setting goals that will guide them before, during and after learning activities. Although teachers still set goals for students with choices, one choice is whether to participate in the task. This depends on such process as learners' goals, values and self-efficacy. Because learners also choose the methods they use while performing the task; for example, which strategies they will employ and which relaxation techniques they use if they becomes anxious. Another type of choice involves outcome, which outcome do learner's desire? as they work on the task they monitor their performance and judge whether their performance are moving towards outcome attainment. Finally learners may be able to choose to structure their environment to make them conducive to learning and seek help when they need it.

Designing learning tasks and monitoring**:** While teachers plan general learning tasks, for example, to produce a product to illustrate a concept, historical sequence, personal experience, and so on, students assume much more responsibility in a collaborative classroom for planning their own learning activities. Ideally, these plans derive in part from goals students set for themselves. Thoughtful planning by the teacher ensures that students can work together to attain their own goals and capitalize on their own abilities, knowledge and strategies within the parameters set by the teacher. Students are more likely to engage in these tasks with more purpose and interest than in traditional classrooms, (Schunk, 2009).

There is an overlap between collaboration and self-regulated. Students learn to take responsibility for monitoring, adjusting, self-questioning, and questioning each other.

Such self-regulating activities are critical for students to learn today, and they are much better learned within a group that shares responsibility for learning. Monitoring is checking one's progress toward goals. Adjusting refers to changes students make, based on monitoring, in what they are doing to reach their goals. For example, a group of students decided that the sources of information on the Civil War they selected initially were not as useful as they had hoped, so they selected new materials. Another group judged that the paper they had planned to write would not accomplish what they thought it would the way they had organized it, so they planned a new paper.(Johnson & Johnson, 2009)

Students can further develop their self-regulating abilities when each group shares its ideas with other groups and gets feedback from them. For example, in a video conference, elementary students could be shown collaborating in small groups to define and represent mathematic problems. Working in small groups, the children would determine what was being asked in solving problems and think of ways to solve the problems. Then each group would share its ideas with the whole class. Members of the class will comment on the ideas. As the students develop problem-solving skills with feedback from other groups, they would learn more about regulating their own learning which they could use in the future (Zimmerman & Schunk, 2008).

Assessment**:** While teachers have assumed the primary responsibility for assessing students' performance in the past, collaborative classrooms view assessment much more broadly. That is, a major goal is to guide students from the earliest school years to evaluate their own learning. Thus, a new responsibility is self-assessment, a capability that is fostered as students assess group work.

Self-assessment refers to ongoing monitoring of one's progress toward achievement of learning goals. In a collaborative classroom, assessment means more than just assigning a grade. It means evaluating whether one has learned what one intended to learn, the effectiveness of learning strategies, the quality of products and decisions about which products reflect one's best work, the usefulness of the materials used in a task, and whether future learning is needed and how that learning might be realized. (Samuelson, 2010)

Collaborative classrooms are natural places in which to learn self-assessment. And because decisions about materials and group performance are shared, students feel freer to express doubts, feelings of success, asking questions, and uncertainties than when they are evaluated only by a teacher. Furthermore, the sense of cooperation (as opposed to competition) that is fostered in collaborative work makes assessment less threatening than in a more traditional assessment situation. Ideally, students learn to evaluate their own learning from their experiences with group evaluation (Schunk, 2009).

e. Self-regulated learning

Self-regulation of cognition and behaviour is considered an important aspect of students' learning and academic performance in the classroom context. The Programme for International Student Assessment (PISA) defines self-regulated learning as motivation to learn and ability to select appropriate goals and strategies for learning (Samuelson, 2010). According to Winters (2009), three components of self-regulated learning seem especially important for classroom performance. First, self-regulated learning includes students' meta-cognitive strategies for planning, monitoring and modifying their cognition. Secondly, students' management and control of their efforts on classroom

academic tasks has been proposed as another important component of self-regulated learning. For example, capable students who persist at a difficult task or block out distractors such as noisy classmates, maintain their cognitive engagement in the tasks, enabling them to perform better. A third important aspect of self-regulated learning that some researchers have included in their conceptualization is the actual cognitive strategies that students use to learn, remember, and understand the material (Zimmerman, 2008). Following from these views, cognitive strategies such as rehearsal, elaboration, and organizational strategies have been found to foster active cognitive engagement in learning and result in higher levels of achievement.

Zimmerman and Schunk (2008) defined self-regulated learning as self-generated thoughts, feelings and actions that are systematically oriented toward the attainment of students' own goals. The term refers to the ability to control and influence one's learning processes, for example, planning, goal setting, strategy implementation, summarising and monitoring one's progress. Barak (2009) suggested a general model of promoting self-regulated learning in technology education which can be applied to the learning of basic science at the upper basic school level. The model consists of three main dimensions, namely: cognition, meta-cognition, and motivation.

The cognitive dimension of this model concerns educators understanding that learning is developmental, and that people best learn and construct new knowledge by building on their current knowledge through active experience with the physical environment, for instance materials, tools and sophisticated artefacts such as computers. Cognition is also about educators understanding that learning occurs through social interaction, and collaboration among learners, instructors, parents and experts outside the

school. These views of learning have been influenced by several learning theories such as Piaget's theory of cognitive development Vygotsky's (1978) socio-cultural theory and discovery theory by Bruner (1960).

The meta-cognitive dimension of the self-regulated learning in technology model deals with individuals' awareness of their learning, their ability to set goals, consider the nature of the task and reflect on their learning. In the context of constructivist and discovery model, successful learning also involves the intentional use of strategies, techniques or heuristics that can help in the process of problem-solving and invention, rather than relying solely on random search or trial-and-error (Barak, 2009).

The motivational aspect of the model is chiefly concerned with students' intrinsic satisfaction from being engaged in challenging assignments and their self-efficacy beliefs about their ability to accomplish a task. This means that in order to promote students' achievement, students also must be motivated to use the strategies as well as regulate their cognition and effort (Hill, 2007). Although there are classroom situations and tasks that can foster motivation, there also is evidence to suggest that students' perceptions of the classroom as well as their individual motivational orientations and beliefs about learning are relevant to cognitive engagement and classroom performance (Slavin, 2007). He goes further to suggest that individual differences of students, such as personal characteristics in terms of motivation are related to students' cognitive engagement and classroom academic performance.

Self-regulation also involves choosing among different behaviours and deferring immediate reinforcement in favour of delayed and usually greater reinforcement. People

self-regulate their behaviour by initially deciding which behaviours to regulate. There are sub-processes of self-regulation which include

Self-monitoring- refers to deliberate attention to some aspect of ones behaviour and often is accompanied by recording its frequency and it place responsibility for behavioural assessment on the students in Schunk (2008). Monitoring progresses rather than who evaluate it, enhanced learner perception of their learning progress and self-efficacy (Schunk, 2008)

Self-instruction- refers to establishing stimuli that set the occasion for self-regulatory response leading to reinforcement (Christian &Pepple,2012) self- instruction is not the same as self-instructional training, it involve arranging the environment to produce discriminative stimuli for instance, student who realize they need to review class note the next day might write themselves a reminder before going to bed.

Self- reinforcement: refers to the process whereby individuals reinforcement themselves contingent on their performing a desired response which improve academic performance (Bandura, 2011).

Self-judgment- refers to comparing present performance level with one goals. It depends on the type of self-evaluative standard employed, properties of the goal, importance of goal attainment and attribution (perceived cause of outcomes) along with goal progress judgement can affect self-efficacy, motivation achievement and effective reactions (Schunk, 2008).Student who believe they are not making good progress towards their goals may attribute their performance to low ability, which negatively impacts expectances and behaviours. Students who attribute poor progress to an inadequate

learning strategy may believe they will perform better if they work harder or switch to a different strategy.

Self-reaction**:** refers to goal progress motivation behaviour. The belief that one is making acceptable progress along with anticipated satisfaction of accomplishing the goal which enhances self-efficacy and sustains motivation (Zimmerman & Schunk, 2008).They further stress that negative evaluations do not decrease motivation if learners believe they are capable of improving/progressing with enhanced efforts. They are apt to feel efficacious and redouble their efforts.

Affective techniques: Affective learning technique is one of the components of Self-regulated Learning Strategy. It create a favourable psychological climate for learning (Wayne, 2013).This method help one cope with anxiety develop positive belief (self-efficacy, outcome, expectation, attitudes) set goals, establish a regular time and place for studying and minimize distraction. Affective techniques help learners focus and maintain attention on important task aspect, manage time effectively and minimize anxiety.

2.4 Empirical Studies

In this aspect of the study, relevant empirical works of other researchers involving teaching strategies and students' achievements are reviewed.

Samuelson (2010) carried out a study on the effect of peer collaboration on children's arithmetic and self-regulated learning skills among 7th grade students in Sweden. The focus of his study was on the effect of peer collaboration compared to traditional and independent teaching of students' arithmetic proficiency, conceptual

understanding (quantitative concepts) and procedural fluency (calculation). Outcome variable was changes in arithmetic ability.

The researcher used the split-plot factorial design with group, that is, peer collaboration: traditional Vs independent work as a between-subject factor and time that is, before and after a 10 week intervention) as a within-subject factor). A total of 110 participants took part in the study. There were 60 males and 50 females participants respectively and all of them were 13 years average. The findings of the study showed that: with regard to effect of teaching methods on arithmetic skills, there was no general effect of the variation of teaching methods on arithmetic proficiency and that there was generally a similar improvement in arithmetic scores in total across all teaching methods (P.>05). However, there was a significant main effect for time (P<.001) suggesting that skills in arithmetic were improved across teaching groups.

With regard to the effect of teaching methods on self-regulated learning skills, the result indicated a significant main effect for time on each subcomponent of self-regulated learning skills, namely, internal motivation (P<001), instrumental motivation (P<.001), self-concept (P<.001) and anxiety (P<05). This suggests that all these four aspects of self-regulated learning skills improved across groups and that the students scored higher on post-test than pre-test. The result further indicated that peer collaboration seemed to be the most effective teaching method in order to develop the students' interest and enjoyment in mathematics among this cohort of Swedish students.

Even though the study was carried out on the effect of peer collaboration on children's arithmetic and self-regulated learning skills, first and foremost, the study was conducted in mathematics not basic science. Secondly, the area of the study was Sweden

and not Benue state Nigeria. The study centred on the effect of peer collaboration compared to conventional methods on achievement and self- regulated learning skills, and the target population was 7th grade which is the primary pupils and not junior secondary school students as is the case in the present study. Thus, conducting a similar study in basic science with Benue State Nigeria as the study area where the findings will be put to use is considered needful.

Poellhuber, Chomienne, and Karsenti (2008) investigated the effect of peer collaboration and collaborative learning on self-efficacy and persistence in a learner-paced Continuous Intake model. The aim of the study was to find ways to improve persistence rates in the distance courses of the Cegep@ distance, and hence reduce the drop-out rate. The specific objective of their study was to understand the impact of peer interaction and collaborative learning on student self-efficacy beliefs and persistence in a distance-education context. A quasi-experimental design was used to compare the self-efficacy and persistence measures of groups where peer interaction was encouraged through computer-mediated conferences (CMC) to other groups taking a corresponding version of the same course (without peer interaction), tutored by the same teachers. A total of 308 participants, all of the students who registered in the chosen courses at the Cegep@ distance with the chosen tutors between March 31, 2004 and November 29, 2004 took part. In the collaboration condition, 12 participants were in the treatment group and 42 in the control, while in the peer interaction condition, 126 participants were in treatment and 128 were in the control groups respectively.

It was hypothesized that the introduction of collaborative activities would facilitate students' contact, enhancing peer learning and help-seeking strategies as well as

boosting the students' motivation in a way that would improve their persistence in selected courses. The findings that relate to peer collaboration (peer interaction) which came out from the analysis of the qualitative data focused on the evolution of the students' motivation in the course and on the paths that led to persistence or drop-out. More specifically, the findings indicated that most students encountered difficulties at some point in the course, even with favourable academic background. The difficulties were of different types and included comprehension, time management and personal being the most frequently cited. If left unresolved, these difficulties were associated with a decrease in motivation and engagement in the course. Students who turned to resources in their environment for support (tutors, peers, or members of their social network) seemed to overcome these difficulties, but students who ended up dropping out of the course tended to remain isolated; trying to resolve their difficulties by themselves and not resorting to their peers, tutor or social network for help. Tutor contact was often mentioned in association with an increase in self-efficacy. The study investigated the effect of peer collaboration on self-efficacy and persistent rates in the distant courses in education context. This present study differs in that, it is not related to influence of motivation and persistence in the distant learning courses, rather the effects of peer-collaboration and self-regulated learning instructional strategy on achievement scores and the area of study is Benue State. Also, the target population is the upper basic students. The area of study and the level of students are not indicated in their studies as well as the subject. These observed differences may cause disagreement in the findings.

In another study on peer collaboration and students' achievement, Davidson (2006) investigated the effects of collaborative learning method on achievement,

retention and attitudes of Home Economics students in North Carolina. The aim of the study was to examine the effect of collaborative learning approach on Students' Team Achievement Division (STAD) on the achievement of content knowledge, retention, and attitudes towards teaching method. The sample size of the study was 194 students. The research design used in the study was a quasi-experimental design. An achievement test consisting of items from the state competency test-item bank for the course and an attitude questionnaire were administered on the students as tools for data collection.

The multivariate analysis of covariance was employed as the statistical tool for data analysis. The result indicated among others no significant differences among the two dependent variables (achievement and retention) between the teaching methods used. The findings implied that collaborative learning was not found to be more effective than traditional learning methods with regard to Home Economics Students' achievement and retention in the study.

The study recommended that further research should be carried out to increase the generalization of the findings outside the sphere of Home Economics Education. The study was conducted on the effect of peer collaboration learning method on achievement, retention and attitude of home economics students in Northern Carolina. This present study differs from the reviewed study because the study was conducted in home economics and not basic science and the area of study is Northern Carolina, United States of America and not Benue State of Nigeria. The study centred on students' achievement retention and attitude of home economic students, while the present study centred on student- student(peer- collaborative learning), student –content(self-regulated learning/ self-monitoring), and student- instructor(conventional methods)interaction patterns on

achievement. Thus conducting a similar study in basic science in Makurdi Benue state as the area of the study where the findings will be put to use is considered more meaningful with respect to application.

Still on the effect of peer collaboration and students' achievement in science, Winters (2009) carried out a study entitled "Peer collaboration as the role of questions and regulatory processes in conceptual-knowledge learning". The purpose of the study was to investigate the impact of peer collaboration and reasoning questions on high-school students' conceptual-knowledge learning, through analysis of their regulatory learning process as they studied the circulatory system using a hypermedia encyclopaedia. A total of 133 participants (55 males and 78 females) formed the sample size of the study. They were drawn from both private and public high schools from the mid-Atlantic region, USA.

The research design employed for the study was a mixed-method design, including both quantitative and qualitative. The quantitative portion of the design was a 2 (learning condition: peer learning Vs. Individual learning) X 2 (questioning condition: question vs. no question) factorial design. The dependent variable was a measure of conceptual knowledge administered prior to (pre-test) and following the intervention (post-test). The independent variables were the learning and questioning conditions, with two levels in each. The results showed that:

i. There was no significant main effect for peer collaboration condition (F, (1,128) = 2.39, P>.05), indicating that those learning with a peer did not have significantly higher post-test scores than those learning individually at the P<.05 level of significance.

ii. The pairs of students who worked collaboratively, and both of whom made larger gains from pre-test to post-test in conceptual knowledge in science than those who used active learning strategies, constructed knowledge together and gave positive feedback. They further identified information that was critical to understanding circulation conceptually. In effect, these groups made use of self-regulated learning skills.

The study concluded that there are a number of factors that may be related to the success of peers engaged in structured collaborative learning. The first factor that may be related to success is student's perception that the task: (a) involves working with a peer to build a shared understanding, (b) is ill-structured; and (c) requires active learning processes in its execution.

The second factor related to success may be the use of high-quality self-regulatory processes, while the third factor related to success in some prior knowledge of the topic and fourth factor is time. The researcher concluded that there appear to be several individual (i.e. task perception, ability to regulate learning processes and prior knowledge) and contextual (i.e. time of task) factors that may be related to how successful students are when they engage in peer collaboration with an ill-structured task; and that students' prior academic experiences may play a crucial role in determining the individual factors that students bring to a collaborative pair.

The study carried out by Winters (2009) is similar to the present study in the sense that, it is on peer-collaboration but differs from the present study because, it involves the use of questioning techniques on high school students' conceptual knowledge. The area of study was Mid-Atlantic region USA. The result indicated that there is no significant difference between student-student interaction and student-content

interaction patterns on student's achievement. The researcher is of the view that using peer collaboration (student-student) and self-regulated learning strategies (student-content) interaction in a different study area Makurdi, Benue State of Nigeria and at the upper basic school level in Basic science may yield a better result.

Igboko and Ibeneme (2011) conducted a study in Nigeria to determine the effect of collaborative/co-operative learning skills on students' achievement and retention in Introductory Technology. Two hypotheses guided the study while quasi-experiment of non-equivalent control group design was employed in the study. The sample size included 100 students from two selected secondary schools in Owerri, fifty from each school. The instrument used was the introductory technology Achievement Test (ITAT) and was administered before as pre-test, and as post-test after the experiment and three weeks later as retention test. Data was analysed using analysis of co-variance (ANCOVA) and findings showed that (a) both the experimental and control group are equally effective as F-cal < critical (0.081, 3.920 respectively) (b) also there was no significant difference found between the conventional lecture method and collaborative/ co-operative learning instruction methods as regards retention. F-critical 0.365< F-cal. 39.20.

The researchers did not state if they ensure the five elements of cooperative learning were employed. These same proponents of cooperative learning instructional strategy insists cannot be co-operative learning but group work Johnson and Johnson (2005), Salvin (2007) claim these five elements make for a successful cooperative learning instructional strategy. Also the researcher did not state the model of cooperative learning instructional strategy employed. It is therefore possible that the class was only grouped to perform task and this may explain the result obtained by the researchers in

their study. The present study uses ANCOVA like the studies of Igboko and Ibeneme (2011) for data analysis. Subject used by researcher was 100 biology students while this present study uses 128 Basic science students and not introductory technology, the study population is similar both used upper basic and the area of study was Owerri not Makurdi and strategies used for this present study is peer collaboration and self-regulated strategies on achievement and not retention. Will this present study produce the same result as that of Igboko and Ibemiene? The researcher hopes that the study will produce a better result at the study.

Cromley and Azevedo (2011) examined the effectiveness of self-regulated learning (SRL) training in facilitating college students' learning with hypermedia in a study entitled "Does training on self-regulated learning facilitate students learning with hypermedia?"

A total number of 131 undergraduate students (96 females and 35males) formed the sample size of the study. They used a 2x2 mixed design i.e. 2 (condition; SRL, control x 2 (time, pre-test, post-test). Two research questions were tested, namely, (i) Does training students to regulate their learning influence their ability to shift to a more sophisticated mental model of the circulatory system? And (ii) How does SRL training influence students' ability to regulate their learning from hypermedia?"

With regard to the first research question, the results of the study revealed that students in the SRL training condition gained a deeper understanding than did the control students when using a hypermedia environment to learn about complex science topics ($F(1,129)=310.06$, $P<.05$). The researchers concluded that students can be trained to regulate their learning with hypermedia by engaging in several key processes and

mechanisms related to SRL, such as planning, monitoring and enactment of effective strategies. The results further indicated that a variety of empirically based SRL strategies led to superior learning gains. The result showed that the students who did not receive SRL training gained significantly less conceptual understanding during learning about a complex science topic with hypermedia environment; this indicates that providing students with an overall learning goal and no training on how to regulate their learning leads to inferior shifts in conceptual learning.

With regards to the second research question, the researchers' extensive think-aloud protocols indicate that not only did the learners in the SRL training condition gain a deeper conceptual understanding, but they also, more frequently deployed the SRL processes taught them to effectively regulate their learning, and that the use of these processes led to significant increases in students' understanding of the science topic. They (students) regulated their learning by planning, (prior knowledge activation planning), meta-cognitively monitoring their cognitive system (judging their learning, feeling of knowing) and their progress toward goals, deploying effective strategies such as drawing, summarizing, taking notes, reading notes, elaborating knowledge etc.

Though this study dwelled on the effectiveness of Self-regulated Learning Strategy with hypermedia, its findings may not apply to basic science classroom at the upper basic school level because the study population was undergraduate students, and the subject area was biology (circulatory system) and the training was with hypermedia environment therefore the researcher is of the view that using upper basic students of basic science may achieve better result in Makurdi and Benue state at large.

Radovan (2011) investigated the relation between distance students' motivation, their use of learning strategies, and academic success. The purpose of the study was to explore distance students' perception of motivation and use of SRL strategies and the ways in which SRL influences their academic success. The question guiding the collection of data was mainly focused on what SRL strategies are related to achievement in a distance-learning course. A total of 319 university students made up of 83 males and 236 females, aged between 20 and 49 years (M= 29.6 years, SD= 6.5 years) took part in the study. The data collected were subjected to multiple regression analysis. The results revealed that goal setting, task value, self-efficacy and effort regulation were the main SRL strategies that led to better academic achievements in the students' chosen distance programme. It was concluded that when studying in a distance-learning course, students who set themselves more intrinsic goals, value their learning, believe in their ability to successfully accomplish academic demands and can handle distractions and maintain concentration on the task.

The study was to explore distant students' perception of motivation and the use of Self-regulated Learning Strategy on academic successes. But for the fact that the study centred on distant learning students at the university level, leaving out the secondary school level which is the foundation of all science education disciplines. There is need to determine the effect of Self-regulated Learning Strategy on secondary school students achievement in Basic science in Makurdi metropolis. And its findings will be appropriate for adoption and use in all aspect of science education.

In a study by Arsal (2011), the researcher examined the impact of self-regulation instruction on mathematics achievements and attitudes of elementary school students

towards the subject. The purpose of the study was to find out the impact of self-regulation instruction on fractions and decimal numbers on academic achievement and attitude towards mathematics in elementary school programme in North Nicosia, Turkey. A sample of 60 fourth-year students enrolled in two elementary schools in Northern Turkey, made up of 29 females and 31 males took part in the study. Their mean age was ten year old. The study employed a pre-test, post-test experimental design.

The results showed a significant difference in performance on the post-test scores with the experimental group scoring significantly higher (M= 19.86, SD= 3.71) compared to the control group (M= 15.56, SD = 4.87); (t (58) = 3.84, P = .000). It was concluded that the higher academic achievement in fractional and decimal numbers in mathematics course in the elementary school programme by the experimental group students over their control group counterparts was due to the self-regulated learning activities embarked upon by the former. Furthermore, self-regulation instructions positively affected self-efficacy beliefs of the students towards and interests in mathematics. It was recommended that in order to increase students' mathematics achievement at the elementary school level, teachers should provide instruction on self-regulated learning strategies such as on how to monitor, control and evaluate their own learning.

In as much as this study investigated the impact of self-regulated learning instruction on students' achievement the fact still remains that study was conducted in mathematics (fraction and decimals) at elementary schools in Northern Turkey and not in Basic science at upper basic school level in Makurdi, Benue state, Nigeria. Therefore adopting the findings of this work for use in basic science in classroom in Benue state may seems unreasonable hence conducting an investigative study on the effect of self-

regulated learning instruction on students' achievement in basic science at upper basic school level in Benue state and applying finds of such a study appropriate lead to more meaningful application in basic science classroom.

Ibe (2008) investigated the effect of instructional materials manipulation on breaking gender barriers on achievement of male and female student in STME in University of Nigeria Nsukka. One hundred and fifty (150) senior secondary were randomly selected. He employed the quasi-experimental design using the pre-test post-test non-equivalent group. Treatment involved teaching biology students using hands on, minds on activity (guided inquiry), demonstration method and lecture method. The research was guided by two research questions and two hypotheses.

A twenty items biology test was constructed by the researcher consisting of section A which is made up of ten practical questions and section B made up of ten multiple choice objectives questions. The instrument had reliability co efficient of 0.791 and 0.790 respectively. Data obtained were analysed using mean and standard deviation while ANCOVA was used to test the hypotheses. Findings revealed that the hands on, minds on (guided inquiry activity)group had gain score of 20.32 over demonstration group who had a gain score of 11.04 and the control group(lecture) had least score of (7.562).No significant difference was found between the mean achievement scores of boys and girls when exposed to each of the teaching methods. The researcher used one hundred and fifty senior secondary biology students for the conduct of the experiment however the number of male and female students were not stated, since gender is a moderator, this could have been stated. This present study will use both male and female students for the conduct of the experiment. The researcher used senior secondary school

biology student in Nsukka, while the present study will use upper basic school basic Science students' in Makurdi Local Government Area of Benue State

Akalonu (2008) conducted a study on the use of female friendly curriculum materials on the achievement and interest of female and male upper basic 1 students (males=1150, females = 388) a total of 1538 students participate in the study. Instrument used was female gender friendly curriculum materials (FGFCM). Finding showed that the achievement test scores of female students (62.54 SD =17.09) was higher than those of male students, mean test scores (47.77 SD 13.42). Also ANCOVA for the effect of FGFCM on achievement in Integrated science revealed a significant difference F =436.84 at $p > 0.05$. Also the interest scores by gender showed females mean scores of (62.54 SD=13.42). Analysis by gender showed on F value of 163.105 at $p < 0.05$, showing high significant level. The study as interesting and important as it is to science education, the researcher did not report the method used to conduct the study as well as the reliability of the instrument. Also another lapse was the subject used there was not mentioned and where the study was carried out. This researcher deduced from the tables of findings presented the number and the method of data analysis used as they were not stated. The present study used a total of 128 students and data will be analysed using standard deviation, mean percentage scores and ANCOVA. Will this present study yield the same result?

Afolabi and Yusuf (2010) studied the effects of student-content interaction in individualized computer assistant instructions, student-student in cooperative computer assisted instruction and student-teacher interaction in conventional instructional approach on secondary school student's performance in biology. The research design adopted was

pre-test post-test non-equivalent, non-randomised, control group quasi- experimental design. The target population was the first year senior secondary school student in Oyo town and Ibadan city. The sample size of the study was 120 students from purposively sampled schools. The nature of study warranted this sampling techniques because only school where computers are available for students use and students are computer literate can be employed. The sample for the individual computer assisted instruction (experimental group 1), cooperative computer based assisted instruction (experimental group 2) and conventional instructions (control group) were 40 students each.

The research instrument used for the treatment was Biology Performance Test(BIOPET) the treatment instrument CAIP on biology was self-instructional, interactive packages developed by the researcher. The test BIOPET consisted of 30 multiple-choice items drawn from past West African Examinations Council (WAEC) Senior Secondary School Certificate Examination Biology paper II question. The test was based on a table of specification covering the six levels of cognitive domain of learning.

In this study, all the groups were subjected to BIOPET as pre-test then the students were exposed to their respective treatments. The control group was taught using chalkboard, overhead projector and chart. After the treatment which lasted for five weeks, the group were exposed to same BIOPET but had items re arranged as post-test. The results of students in three groups were analysed using ANCOVA (Analysis of Co variance). The result indicated a significant difference in performance that was in favour of students in the experimental group. Scheffe test was used as post hoc to locate the performance of students exposed to individualized and cooperative computer assisted instruction; the two experimental groups and control group. However students exposed to

cooperative computer assisted instruction did better than those exposed to individualised computer –assisted instruction. Based on these findings, the student-student and student-content interaction patterns had greater positive effects on student achievement in biology compared to the student-instructor pattern, however the student-student interaction had an edge over the student-content interaction pattern.

Laudable as the result of this research is, the practicability of its application in the conventional Nigeria classroom may be difficult for so many reasons notably the paucity of computer in secondary school couple with students and biology teacher's competence in the use of computer-assisted instructional approach. In addition the target population of the study was secondary school in Oyo, Ibadan town and not Makurdi Benue State.

Thus conducting a similar study in Makurdi Benue state using human and material resources instead of Computer Assisted Instruction(CAI) readily available in conventional basic science classroom as this study intends to do may yield more practical value in learning basic science in the present day Nigeria.

2.5 Summary

This study is anchored on Bruner's theory of learning by discovery, Piaget's developmental theory and Vygotsky's theory of Socio-Cultural learning. The three put together formed the theoretical foundation for the study. By peer collaboration and self-regulative studies, learners apply socio-cultural theory, learning by discovery in line with their age of development. Learners are only exposed to tasks within their intellectual capacity to allow learning to take place.

The conceptual reviews are on strategies for teaching basic science, traditional teaching method, gender and learning of science, peer collaboration learning, characteristics of a collaborative classroom, teachers' role in collaborative classroom, students' role in a collaborative classroom, goal setting and concept of self-regulated learning. In general, is found that the two major concepts used as the teaching strategies used in this study take advantage of students' curiosity, age and mental maturation to engage them in meaningful learning of science.

The review of related literature for this study has provided information on the criteria for ascertaining the effect of peer collaboration and self-regulated learning on achievement. In general, it is agreed by Samuelson (2010) that peer collaboration method or collaborative interaction is an effective strategy used for teaching and learning of science. Also, self-regulated learning instruction is considered an important aspect of students learning and academic achievement in the classroom context. It was also stressed that Self-regulated Learning Strategy enables one to control and influence his/her behaviours and or learning processes which positively affects self-efficacy and beliefs about their capability to perform classroom task.

From the review, most studies were in the area of mathematics, home economics and biology. There is dearth of research reports with particular reference to self-regulated and collaborative studies in Benue state particularly in Basic science among Upper basic 2 (UB2) students'. The present study therefore is expected to fill the gap identified and provide empirical evidence using two variables; Peer collaborative and self-regulated learning strategies.

CHAPTER THREE

RESEARCH METHOD

3.1 Introduction

This chapter outlines the approaches and techniques used to collect and analyse data for the study. Specifically the design of the study is described, then followed by area of the study, population, sample and sampling technique, instrumentation, validation of instruments, reliability of instrument, method of data collection and method of data analysis.

3.2 Research Design

This study employed the quasi- experimental design. Specifically, the **3** (learning conditions: self-regulated (SRL) vs peer collaboration (PC) Vs. control (C) **X 2**; (time: pre-test Vs post-test) mixed factorial design was used. The choice of this design was for the fact that, this study used the intact classes because it is not feasible to adopt true experimental design as this will distort the academic programmes of the schools involved, due to randomization of subjects to experimental and control groups. The appropriateness of quasi experimental design for this study was considered on this ground.

The dependent variable of the study is students' achievement measure/recorded as mean scores on the pre-test and post-test on the achievement task. The two independent variables of the study are the learning condition and time condition. Learning condition was measured at three levels namely: Peer collaboration learning, (PCL) Self- regulated learning (SRL) and the Control demonstration method. The time variable has two levels, pre-test (before treatment or manipulation of the variables) and post- test, the learning condition is between-subjects design with three levels Peer Collaborated Learning, Self-

regulated learning and Control Demonstration method. The time condition is a within subject design where learners were tested in the learning condition and each group was compared with itself on the mean achievement scores at the pre-test and post-test. Appendix J, (P.163)

3.3 Area of the Study

The study was conducted in Makurdi Local Government Area of Benue State, Nigeria. Schools in the study area are noted for underachievement in Basic Science. Territorially, the local government area is defined by 16 square kilometre radius covering an area of 80 km sq. It comprises ten political units or wards. The wards include Agan, Ankpa, Bar, Fiidi, Wailomayo East and Wailomayo West. Others are Mission, Mbalagh, Modern market and North bank. Within the larger geo-political divisions of Benue state, the Local Government Area falls within the Zone B Senatorial Area. The local government has many Secondary Schools as well as primary schools that house the basic junior Secondary classes under the Universal Basic Education Curriculum (UBEC) system. There are well over fifty Junior or Basic schools in the Local Government Area. The secondary schools are over seen by the State Teaching Service Board (TSB) while the upper basic schools housed by the Universal Basic Education Board UBEC are under the control of the State Universal Basic Education Board (SUBEB) and the Local Government Education Department of the Board. Ownership of colleges is by the government, missionaries, community and single proprietorship. Some of the schools are co-educational while others are single sexed.The local government area has a latitude of 7.73^{o} N and longitude of 8.54^{o}E. Makurdi Local Government Area is bounded by Guma Local Government Area in the North, South by Gwer East Local Government Area, in

the East by Tarkaa Local Government Area and in the West by Gwer West Local Government Area.

3.4 Population

The total population of this study consisted of 7,034 upper basic two students in 52 Government Grant aided Secondary Schools in Makurdi Local Government Area of Benue state. Out of which 638 upper basic two (UB2) were selected from co-educational Schools which were considered for this study, since gender is a moderator variable in this study.

3.5 Sample and Sampling

The sample for the study consisted of 128 upper basic two (UB2)students from six (6)co-educational Secondary Schools taken from the population of 638 students of grant aided co-educational government secondary schools in Makurdi local government. How it was done was that stratified sampling techniques were first used to select only co-educational schools for this study because of the gender strata. Simple random sampling technique was then used to first select six schools to be used for the study. The selection was done by 'hat and draw' method, and only co-educational schools were used, since gender is a moderator variable. In each of the six schools, one intact class was randomly sampled. The total number of students in the six classes were 128. The six classes were shared into three groups of two schools each. Group 1, was assigned Peer Collaboration Learning Strategy, Group 2 was assigned to Self-regulated learning strategy and Group3 was assigned to Demonstration method.

The sample size of 128 was considered adequate because in line with the views of Maduabum (2008), for experimental studies, a minimum sample size of 15 students per group and 20 percent of the total population of 638 students which give a sample size of 128 students (67boys and 61 girls) is considered adequate to give some confidence that the conclusion reached concerning differences between groups was valid. The sample size used comprises of a minimum of 41 students per group and 20 students per school, hence the adequacy of sample size for the study. (See appendix I, p.162).

3.6 Instrumentation

The instrument used in this study to collect relevant data was Basic Science Achievement Test (BSAT).The researcher developed two forms of BSAT, pre-test, post-test Basic Science Achievement Test (BSAT) for upper basic 2 (UB2) (see appendix D, P.110). The instrument is made up of two parts, section A is the demographic information while section B consists of multiple choice test made up of initial 45 items and later reduced to 40 items after validation with four options (a- d) for the students to answer all, based on Basic Science Curriculum.

The BSAT was administered twice, before (pre) and after (post) the experiment. The pre-BSAT was used to ascertain the level of basic science academic achievement at which the students were before the treatment. The post-BSAT was used to determine the extent of students Basic Science achievement after the treatment. The topics chosen were from basic science book 2 syllabuses/ curriculum.

a. Metabolism of food in human body (digestive system)
b. Drug and drug abuse

c. Elements, compounds and mixtures

d. Disease vectors

The items of BSAT are based on the upper Basic Science curriculum, and most of the questions were obtained from the past JSCE/BECE question papers. Consideration was given to the behavioural objectives of the content taught in the lesson plan as they serve as a guide on determining the number of topics for each of the units studied (see Appendix E, P.120 for lesson plans).

3.6.1 Development of Basic Science Achievement Test (BSAT)

The BSAT consisted of 40 multiple choice objective questions with options (a-d), the items were selected to cover lower and higher order cognitive levels of Blooms' taxonomy of 9educational objectives', a table of specification was used to determine the number of items in different cognitive ability levels and topics. In the table of specification for Basic Science Achievement Test (BSAT),the reflection of questions are seen more at the lower order cognitive level than higher order cognitive level because the study is based on upper basic level (upper basic 2) in Basic Science Achievement Test (BSAT). This is in line with Piagets' theory of cognitive ability, because their level of cognitive ability at this stage is lower compared to the senior secondary students not minding the age of the learners, placement evaluation takes care of this situation.(See Appendix B, P, 106).

In scoring the students on the BSAT, each correct answer was rewarded a score of one point, while every wrong answer was scored zero. The range of score for each respondent was zero and maximum of forty (40) points. Three sets of lesson plans were

developed by the researcher and used in teaching both the experimental and the control groups.

The experimental groups (EG1) lessons were planned using peer collaboration learning strategy and (EG2) Self-regulated Learning Strategy while that of Control group (CG) is planned using the demonstration method. These were given to the trained permanent Basic science teachers that were used in the study. But the content for the three lesson plans were the same.

Lesson plans for both experimental and control groups were planned to cover the topics listed (eg; Digestive System, Drug Abuse, Elements, compounds and mixture, and Disease vectors.) were taught during the study by their regular class teachers (Research assistants). The lesson plans have the same content of upper basics as contained in basic science curriculum for both experimental groups (EGS) and control group (CG). The research assistants (regular teachers) used these lesson plans to teach the students in their various groups with different (treatment) strategies. In experimental group one (1) (EG1), students were exposed to peer collaboration learning strategy (PCLS), Experimental group two (2) (EG2), students were exposed to Self-regulated Learning Strategy (SRLS) and control group (CG), Conventional demonstration method was used to teach the students in their intact class (es) (see Appendix E, P.120). The duration of the lessons lasted for 6 weeks for all the groups. Post- test was administered and collected from the respondents at the end of 6 weeks and was marked by the researcher and the outcome was subjected to statistical analysis to establish level of achievement between the experimental and control groups.

All the students in the two experimental groups received training on peer collaborative learning strategy and Self-regulated Learning Strategy after pre-test for two periods of lessons for 40 minutes each before taking part in the treatment except control group. Firstly, in PCLS after pre-test administration, presentation of text material to the students then an instructions was given to them on how to go about the learning task,(see appendix J, p.163) The guidelines for collaborative learning are as follows;

i. Planning on task to be learnt

ii. Shared knowledge/cooperative efforts on task among teachers and students.

iii. Shared authority among teachers and students.

iv. Heterogeneous groupings of students (students with different background, ideology, experiences)

v. Teachers as a mediator (facilitators, coaching, modelling)

There are five elements of collaborative/co-operative learning that distinguish it from other forms of group learning. These elements are as follows; Face to face interaction, Positive interdependence, Individual and group accountability, Collaborative skills (Interpersonal and small group skills), Group processing.

In summary, peer collaboration learning has four stages as follows,

*Before learning***:** Students set goals and plan learning tasks.

During Learning: They (students) work together to accomplish tasks and monitors their progress.

*After Learning***:** They assess their performance and plan for future learning.

*Teacher***:** Helps them to fulfil their new roles as a mediator/facilitator.

Secondly, for Self-regulated Learning Strategy (SRLS), after pre-test, presentation of text materials, then an instruction was given to them on how to go about the learning task (appendix J, P.163)there are guidelines for self-regulated learning as follows;

i. Planning (on what learning materials to learn)

ii. Goal settings (how to achieve the learning task)

iii. Strategy implementation (SQ4R – *Survey* – students' first survey text materials by reading the chapters, headings & sub-headings, after which they develop *Question***s** in mind. After *Reading,* students try to *recall* what they have read, then they *review* the text materials and *reflect* on them.

iv. Summarizing (salient/key points)

v. Self-monitoring (monitoring ones progress)

vi. Self-evaluation(passing Judgment)

vii. Teacher acts as a guide. (Note that, learning without a teacher in a classroom context/situation is regarded as ineffective). There must be a teacher to guide, direct and instruct what the students must do. Despite the fact that, in non-conventional methods, learning is learner centre that does not mean that the students will learn without the teacher guiding them.

Thirdly, conventional demonstration method is one of the conventional or traditional method used in basic science teaching, which involves carrying out activities

to illustrate concepts or ideas. Demonstration can be carried out by teacher alone, teacher with a student/pupil and or an invited guest. For the purpose of this research work, demonstration method was used as a control group (CG) to compare with the non-conventional methods like the PCLS and SRLS. Demonstration translates an abstract concept to real life subject; develop student's skills of observation, recording, measuring and to create a high degree of attention, concentration and interest in students. However, students' participation in the lesson is less, the method is more of teacher centred approach, and the students only watch, observed keenly and jot down points. Research assistant, who was trained to teach basic science using demonstration method as a control group followed the lesson plan prepared for the group by the researcher.

3.6.2 Validation of Instrument

Both face and content validations were done in this study. The Basic Science Achievement Tests (BSAT), and lesson plans for the three strategies were validated by three experts in science education. For BSAT the experts' advices were sought in terms of scope of coverage, content, relevance, ambiguity and vagueness of expression. The experts also checked, whether the BSAT answers were correct or not. The correction and suggestions made by these experts were used to review the BSAT items to obtain the degree of accuracy to measure what it's supposed to measure.

3.6.3 Reliability of the Instrument

Reliability is the consistency with which an instrument measures what it is supposed to measure (Emaikwu, 2013). To ensure the reliability of this study, a pilot study was conducted using 30 upper basic 2 (UB2) students from ECWA Secondary

School North bank Makurdi. The school was not part of the schools selected for the main study. Two research assistants were trained to handle the experimental groups for six weeks based on the lesson plans. The aim of conducting pilot study was to determine reliability coefficient of the research instrument, to determine the appropriate length of time of the test and also the effectiveness of the research procedure. The BSAT was administered to three groups, before the treatment to ascertain their entry behaviour and after exposure to PCL and SRLS, while the control group was taught using conventional demonstrational methods for six weeks respectively. The students were assessed using BSAT after treatment. The pre-test, post-test items were the same in content but different in organisation and was scored out of 40 points.

The scores obtained were used to calculate the reliability coefficient of the instrument using Kuder-Richardson 20 formula (KR-20) to obtain 0.99.The KR-20 was used to establish the reliability of BSAT because the items have correct or wrong answers scoring nature of the multiple choice test instrument used. This shows that the instrument can measure the objectives of the study (Emaikwu, 2013) (Appendix G, p.160).

The result was further subjected to psychometric analysis. This was an attempt to determine the quality of a test in terms of how difficult the test items may be and how discriminating the distracters are. These were calculated by computing the difficulty, discrimination and distracters indices of 45 test items administered to the pupils (Appendix H, p-161) Harbor- Peters (1990) recommends the following ranges:

i. For difficulty or easiness of indices, the acceptable range is from 0.30 – 0.70.
ii. For discrimination index, the acceptance range is from 0.30 – 1.0.

iii. The distractor index is usually dependent on the number of options and 0.33 is ideal for 4 option format.

Items whose discrimination fall within acceptable level range of 0.30 – 1.0 as well as options whose distracters indices fall within the acceptable range were accepted. However, items whose option falls below the acceptable level of distracters indices but whose discrimination fall within the acceptable range were adjusted. Five items were found to be rejected and so were removed bringing the final total items to 40.

3.7 Method of Data Collection

Research assistants were used for the collection of data. The research assistants (RA) who were trained by the researcher for a week before the commencement of the experimentation as stated in the experimental procedure, Pre-BSAT was administered before the treatment, while post BSAT was administered after treatment. The BSAT was scored out of 40 points. The scores from the pre-test served as covariance for the study.

3.8 Experimental Procedure

After visiting the sampled schools and seeking the permission from the principals of the schools to use their schools for the study. Six basic science teachers from the selected schools were recruited to serve as research assistants in the study.

3.8.1 Training of Research Assistants

The training of the research assistants lasted for one week during which they were exposed to treatment as follow;

a) The researcher explains the objectives of the study to the research assistants (R.A).

b) They were exposed to the detailed lesson plans and lesson notes prepared by the researcher.

c) The research assistants were exposed to the new approach: peer collaboration and self-regulated learning strategies which was presented separately to the teachers in the experimental groups each instructional strategy was discussed with the teachers that will use it.

d) The topics selected for instruction based on the upper basic science curriculum such as digestive system, drug abuse, elements, compounds mixtures and disease vectors.

e) The research assistants also were trained in the administration of BSAT items. (See appendix L, p. 165 for training Manual)

During the training period each of the four teachers to teach experimental groups, were made to teach for a minimum of forty minutes on a particular aspect of the selected topics. The research assistants were critique and corrections were done where necessary. The two research assistants for the control groups were also given the lesson plans for the topics to be taught and instructed to use their usual demonstration method of instruction for the lesson plans used in the training of peer collaboration and self-regulated learning instructional strategies (see Appendix K P.164 for training schedule)

3.8.2 Administration of Instruments

The administration of instrument was done in three phases; first phase is the administration of pre-test to the students a week before the treatment after the administration of the pre-test. Secondly the students were taught the selected topics for six (6) weeks in the same intact classes (treatment).

The research assistants who participated in this study were the same teachers who teach the students in the sampled schools for both the treatment and control groups to reduce Hawthorne effects. Research assistants were instructed to explain the behavioural objectives of each topic to the students in the peer collaboration and self-regulated learning groups before teaching, while control group, the teacher was not to communicate the objectives of the topic to the students before teaching as it is commonly practised. All class periods were 40 minutes long and all the subjects will follow the same class schedules of Mondays through Fridays. Thirdly after the treatment, a post test was administered to the students using Basic Science Achievement Test (BSAT). The researcher supervised the administration of the instrument with their research assistants to ensure similarity in test conditions.

The BSAT was administered by the researcher and six of the research assistants. The students responded to the instrument after appropriate procedures have been explained by the researcher and research assistants and the administration lasted for a period of 40 minutes. BSAT was administered before the commencement of the study as pre-test and after the study as pot-test. The periods between the pre-test and post-test was 6weeks. This period was long enough to prevent the pre-test from affecting the post-test scores or to interfere with experimental treatment Achor (2011).The pre-test and post-test items were the same in content but maybe different in organisation. Appendix J, P.163) for experimental procedure

3.8.3 Experimental Control

The following extraneous factors were controlled in order to eliminate experimental biases

a) The subjects in the treatment and control conditions received the same content area, same instructional materials and same length of time to work on the learning task.
b) The lesson plans and notes were prepared by the researcher and given to the teachers for implementation.
c) Both experimental and control groups completed the treatment within the period of six(6) weeks, using 80 minutes periods per class with total of 3 periods per week with 18 unit lessons.
d) Control of Hawthorne effect: This happens when students performance are affected because they are aware that they are being used for an experiment. To eliminate this problem, regular basic science teachers in the sample schools were trained and used for the study.
e) Control of experimental bias; the actual teaching of the experimental and control groups was not be done by the researcher, rather by regular teachers to avoid possible bias that might arise from the researcher.
f) Control of the effect of pre-test on post-test; the period between the pre-test and post-test was at the end of the 6^{th} week. This period was adequate enough to prevent the pre-test experience from affecting the post-test (Achor 2011).

3.9 Method of Data Analysis

Data collected through the BSAT were classified into pre-test and post-test for both experimental and control groups. Data collected were analysed with respect to the research questions and hypotheses. Descriptive statistics of means and standard deviations were used to answer all research questions. The inferential statistics of Analysis of Covariance (ANCOVA) was used to test all the hypotheses at 0.05 significant levels.

The choice of ANCOVA in this study was because of the intact classes used for treatment and control groups respectively. The differences between the pre-test and post-test means score were analysed to determine the statistically significance between and within the groups as covariance between pre-test and post-test. ANCOVA performs a type of regression which controls variables when examining the relationship between two or more variables (Emaikwu, 2008):

i. It statistically removed pre -existing differences among groups which are used in experimental test but which must be assigned intact to various treatment conditions

ii. It removed difference on the dependent variables which may be due to difference in extraneous variables

CHAPTER FOUR

INTERPRETATION, ANALYSIS AND DISCUSSION

4.1 Introduction

In this chapter the data is presented analysed, interpreted and discussed. The findings are presented in respect to the research questions and hypotheses formulated. Lengthy data and calculations are contained in the appendices.

4.2 Analysis and Interpretation

Data analysis and interpretation is according to research questions and hypotheses.

Research Question 1

What is the effect of peer-collaboration learning strategy and demonstration method on Upper Basic 2 students' achievement in basic science in Makurdi Local Government Area?

Table 1: Mean and Standard Deviation of Students' Scores in Peer Collaboration Learning and Demonstration Strategy Classes

Group		Pre-BSAT	Post-BSAT	Mean Gain
Peer Collaboration Learning Strategy (PCLS)	Mean	21.39	26.46	5.07
	N	46	46	
	Std. Deviation	4.63	5.11	
Demonstration Method (DM)	Mean	12.37	16.88	4.51
	N	41	41	
	Std. Deviation	3.94	4.66	
Mean difference		9.02	9.58	0.56

Table 1 reveals that students in Peer collaboration class had a mean gain of 5.07 while those in Demonstration class had 4.51 with a mean difference of 0.56 in favour of Peer Collaboration Strategy class. This means that Peer Collaboration class received instruction and gained more compared to those in Demonstration class. By implication,

Peer Collaboration Strategy facilitated achievement more in Basic science compared to Demonstration method that is popular and used regularly by the teachers. Therefore Peer Collaboration Learning Strategy enhanced students' achievement in Basic Science better than Demonstration method.

Research Question 2

What is the effect of Self-regulated Learning Strategy and Demonstration method on students' achievement in basic science in Upper basic 2 in Makurdi Local Government?

Table 2: Mean and Standard Deviation of Students Scores in Self-regulated Learning and Demonstration Strategy Classes

Group		Pre-BSAT	Post-BSAT	Mean Gain
Self Regulated Learning Strategy (SRLS)	Mean	18.54	21.76	3.22
	N	41	41	
	Std. Deviation	4.42	5.04	
Demonstration method (DM)	Mean	12.37	16.88	4.51
	N	41	41	
	Std. Deviation	3.94	4.66	
Mean difference		6.17	4.88	1.29

Table 2 reveals a mean gain of 3.22 in Self-regulated Strategy class while those in Demonstration class had 4.51 with a mean difference of 1.29 in favour of the Demonstration method class. This means that Demonstration class received instruction and gained more compared to those in Self-regulated class. By implication, Demonstration method facilitated achievement in Basic science compared to Self-regulated Strategy that was used as experimental class. Therefore Demonstration method enhanced students' achievement in Basic Science better than Self-regulated Strategy.

Research Question 3

What is the mean difference in the achievement scores of Upper Basic (UB2) students taught with peer-collaborative learning strategy and those taught using Self-regulated Learning Strategy?

Table 3: Mean and Standard Deviation of Students Scores in Peer Collaboration Learning and Self-regulated Learning Strategy Classes

Group		Pre-BSAT	Post-BSAT	Mean Gain
Peer Collaboration Learning Strategy (PCLS)	Mean	21.39	26.46	5.07
	N	46	46	
	Std. Deviation	4.63	5.11	
Self-Regulated Learning Strategy (SRLS)	Mean	18.54	21.76	3.22
	N	41	41	
	Std. Deviation	4.42	5.04	
Mean difference		2.85	4.70	1.85

Table 3 shows that students in Peer collaboration class had a mean gain of 5.07 while those in Self-regulated class had 3.22 with a mean difference of 1.85 in favour of Peer Collaboration Strategy class. This means that Peer Collaboration class received instruction and gained more compared to those in Self-regulated class. By implication, Peer Collaboration Strategy facilitated achievement more in Basic science compared to Self-regulated Strategy that was used as another experimental group. Therefore Peer Collaboration Strategy enhanced students' achievement in Basic Science better than Self-regulated Strategy.

Research Question 4

What is the difference in the mean achievement scores between male and female students taught basic science with peer-collaborative learning strategy?

Table 4: Mean and Standard Deviation of Male and Female Students' Score in Peer collaboration Learning Class

Gender		Pre-BSAT PCLS	Post-BSAT PCLS	Mean Gain
Male	Mean	21.29	26.52	5.23
	N	21	21	
	Std. Deviation	5.35	5.48	
Female	Mean	21.48	26.40	4.92
	N	25	25	
	Std. Deviation	4.03	4.89	
Mean difference		0.19	0.12	0.31

Table 4 shows a mean gain of 5.23 for the male students in Peer Collaboration Strategy class while the females in the same class had 4.92 with a mean difference of 0.31 in favour of the male students. This means that the male students received instruction and gained more in Peer Collaboration class compared with the female students in the same class. By implication, Peer Collaboration Strategy facilitated achievement more among the male students in Basic science compared with the female students in the same class. Therefore Peer Collaboration Strategy enhanced male students' achievement in Basic Science better than for the female students.

Research Question 5

What is the difference in the mean achievement scores between male and female students taught basic science using self-regulated strategy?

Table 5: Mean and Standard Deviation of Male and Female Students' Score in Self-regulated Learning Class

Gender		Pre-BSAT SRLS	Post-BSAT SRLS	Mean Gain
Male	Mean	18.37	21.74	3.37
	N	27	27	
	Std. Deviation	3.75	4.35	
Female	Mean	18.85	21.79	2.94
	N	14	14	
	Std. Deviation	5.63	6.36	
Mean difference		0.48	0.05	0.43

Table 5 reveals a mean gain of 3.37 for the male students in Self-regulated Strategy class while the females in the same class had 2.94 with a mean difference of 0.43 in favour of the male students. This means that the male students received instruction and gained more in Self-regulated class compared with the female students in the same class. Therefore Self-regulated Strategy facilitated achievement more among the male students in Basic science compared with the female students in the same class. Therefore Self-regulated Strategy enhanced male students' achievement in Basic Science better than for the female students.

Hypotheses Testing

Ho_1: There is no significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using conventional demonstration method.

Table 6: ANCOVA Test of Effects of Peer Collaboration Learning Strategy and Demonstration Method on Students' Achievement in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2701.683[a]	4	675.421	41.610	.000
Intercept	568.246	1	568.246	35.008	.000
PreBSAT	695.204	1	695.204	42.829	.000
Group	130.074	1	130.074	8.013	.006
Error	1331.029	82	16.232		
Total	45921.000	87			
Corrected Total	4032.713	86			

a. R Squared = .670 (Adjusted R Squared = .654)

Table 6 shows that with $F_{1, 86} = 8.01$, $p = 0.01 < 0.05$, there is a significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using demonstration method. This means that the difference in mean between students in Peer Collaboration Strategy class and those in Demonstration method class in Basic Science was significant. Thus the null hypothesis is rejected and it is therefore concluded that there is a significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using demonstration method.

HO_2: There is no significant difference between the mean achievement scores of student taught basic science using Self-regulated Learning Strategy and those taught using conventional demonstration method.

Table 7: ANCOVA Test of Effects of Self Regulated Learning Strategy and Demonstration Method on Students' Achievement in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1651.740[a]	4	412.935	44.038	.000
Intercept	148.751	1	148.751	15.864	.000
PreBSAT	1146.522	1	1146.522	122.272	.000
Group	8.229	1	8.229	.878	.352
Error	722.016	77	9.377		
Total	32972.000	82			
Corrected Total	2373.756	81			

a. R Squared = .696 (Adjusted R Squared = .680)

Table 7 reveals that with $F_{1, 81}$= 0.88, p = 0.35> 0.05, there is no significant difference between the mean achievement scores of students taught basic science using Self-regulated Learning Strategy and those taught using Demonstration method. This means that the difference in mean between students in Self-regulated strategy class and those in Demonstration method class in Basic Science was not statistically significant. Thus the null hypothesis is not rejected and it is therefore concluded that there is no significant difference between the mean achievement scores of students taught basic science using Self-regulated leaning strategy and those taught using Demonstration method.

HO_3: There is no significant difference between the mean achievement scores of students taught basic science using both peer collaboration and self-regulated learning strategies.

Table 8: ANCOVA Test of Effects of Peer Collaboration Learning and Self-regulated Learning Strategies on Students' Achievement in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1403.225[a]	4	350.806	22.674	.000
Intercept	376.115	1	376.115	24.309	.000
PreBSAT	924.074	1	924.074	59.725	.000
Group	134.536	1	134.536	8.695	.004
Error	1268.706	82	15.472		
Total	53797.000	87			
Corrected Total	2671.931	86			

a. R Squared = .525 (Adjusted R Squared = .502)

Table 8 shows that with $F_{1, 86} = 8.70$, $p = 0.00 < 0.05$, there is a significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using self-regulated learning strategy. This means that the difference in mean between students in Peer Collaboration Strategy class and those in Self -regulated Learning Strategy class in Basic Science was statistically significant. Therefore the null hypothesis is rejected and it is concluded that there is a significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using self-regulated learning strategy.

HO_4: There is no significant difference between the mean achievement scores of male and female students taught basic science using peer collaboration learning strategy.

Table 9: ANCOVA Test of Effects of Peer Collaboration Learning Strategy(PCLS) on Male and Female Students' Achievement in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	287.685[a]	2	143.843	6.967	.002
Intercept	439.317	1	439.317	21.280	.000
PreBSAT PCLS	287.510	1	287.510	13.927	.001
Gender	.603	1	.603	.029	.865
Error	887.728	43	20.645		
Total	33373.000	46			
Corrected Total	1175.413	45			

a. R Squared = .245 (Adjusted R Squared = .210)

Table 9 shows that with $F_{1, 45}$= 0.03, p = 0.87> 0.05, there is no significant difference between the mean achievement scores of male and female students taught basic science using peer-collaborative learning strategy. This means that the difference in mean between male and female students in Peer Collaboration Strategy class in Basic Science was not statistically significant. Thus the null hypothesis is not rejected and it is therefore concluded that there is no significant difference between the mean achievement scores of male and female students taught basic science using peer-collaborative learning strategy.

HO_5: There is no significant difference between the mean achievement scores of male and female students taught basic science using Self-regulated Learning Strategy.

Table 10: ANCOVA Test of Effect of Self-regulated Learning Strategy(SRLS) on Male and Female Students' Achievement in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	707.988[a]	2	353.994	43.453	.000
Intercept	33.986	1	33.986	4.172	.048
PreBSAT SRLS	707.969	1	707.969	86.903	.000
Gender	1.617	1	1.617	.198	.658
Error	309.573	38	8.147		
Total	20424.000	41			
Corrected Total	1017.561	40			

a. R Squared = .696 (Adjusted R Squared = .680)

It can be seen from Table 10 that with $F_{1, 40}$= 0.20, p = 0.66> 0.05, there is no significant difference between the mean achievement scores of male and female students taught basic science using Self-regulated learning strategy. This means that the difference in mean between male and female students in Self-regulated Strategy class in Basic Science was not statistically significant. Therefore the null hypothesis is not rejected and it is thus concluded that there is no significant difference between the mean achievement scores of male and female students taught basic science using self-regulated learning strategy.

HO_6: There is no significant interaction effect of method of instruction and gender on the mean achievement scores of students in Basic Science.

Table 11: ANCOVA Tests of Main and Interaction Effects of the Three Strategies and Gender on Students' Achievement in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3367.052[a]	6	561.175	40.317	.000
Intercept	516.524	1	516.524	37.109	.000
PreBSAT	1359.586	1	1359.586	97.679	.000
Group	148.397	2	74.198	5.331	.006
Gender	5.126	1	5.126	.368	.545
Group * Gender	.782	2	.391	.028	.972
Error	1684.190	121	13.919		
Total	66345.000	128			
Corrected Total	5051.242	127			

a. R Squared = .667 (Adjusted R Squared = .650)

It can be seen from Table 11 that with $F_{1, 127}$= 0.03, p = 0.97> 0.05, there is no significant interaction effects of method of instruction and gender on students' achievement in basic science. This means that the difference in mean among the groups (peer collaboration, self regulated and demonstration strategies) and gender (that is, male and female) in Basic Science did not significantly interact to affect students' achievement. Therefore the null hypothesis is not rejected and it is thus concluded that there is no significant interaction effect of methods of instruction and gender on students' achievement in basic science.

4.3 Discussion of Findings

In this study, Peer Collaboration Learning Strategy enhanced students' achievement in Basic Science better than Demonstration method. There was a significant

difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using demonstration method. This finding does not agree with that of Davidson (2006), Winter (2009) and Igboko and Ibeneme (2011) in the sense that, Davidson investigated the effects of collaborative learning method on achievement, retention and attitudes of Home Economics students in North Carolina. Collaborative learning was not found to be more effective than traditional learning methods with regard to Home Economics Students' achievement and retention in the study. Also, Winters (2009) found that there was no significant main effect for peer collaboration condition , indicating that those learning with a peer did not have significantly higher post-test scores than those learning individually at the $P<.05$ level of significance. The pairs of students who worked collaboratively, and both of whom made higher gains from pre-test to post-test in conceptual knowledge in science than those who used active learning strategies, constructed knowledge together and gave positive feedback. They further identified information that was critical to understanding circulation conceptually. In effect, these groups made use of self-regulated learning skills.

The contradiction to the finding of the present study was not surprising as the effectiveness of peer collaboration learning strategy depends on its monitoring and time allowed. For instance, there are a number of factors that may be related to the success of peers engaged in unstructured collaborative learning. The first factor that may be related to success is student's perception that the task involves working with a peer to build a shared understanding. It is ill-structured and requires active learning processes in its execution.

The second factor related to success may be the use of self-regulatory processes, while the third factor related to some prior knowledge of the topic and fourth factor is time. There appear to be several individual differences for example task perception, ability to regulate learning processes and prior knowledge and contextual example. Time of task may be related to how successful students are when they engage in peer collaboration with task; and that students' prior academic experiences may play a crucial role in determining the individual factors that students bring to a peer collaborative activity. The facts remains that in the present study efforts were made to ensure that the task was familiar, structured and were given adequate time and this may have accounted for the reversal in findings compared to previous studies considered here. It therefore implies that if peer collaboration learning strategy must be effective as found in this study, the teacher must carefully plan it, provide adequate time for interaction among peers, structure the task to be given and allow the use of fairly familiar task that may engender coordination and use of prior knowledge. Similarly, the pairs of students who worked collaboratively, and both of whom made higher gains from pre-test to post-test in basic science than those who were in demonstration class probably constructed knowledge together and gave positive feedback.

On the other hand, the present study is in agreement with that of Afolabi and Yusuf (2010) examined the effects of student-content interaction in individualized computer assistant instructions, student-student in cooperative computer assisted instruction and student-teacher interaction in conventional instructional approach on secondary school students' performance in biology. The result indicated a significant difference in performance that was in favour of students in the experimental group.

Scheffe test was used as post hoc to locate the performance of students exposed to individualized and cooperative computer assisted instruction; the two experimental groups and control group showed that, students exposed to cooperative computer assisted instruction did better than those exposed to individualised computer–assisted instruction. Again, computer instructions are highly structured, interactive and engages familiar task. Therefore the similarity in findings of the two studies could be explained with a common reason though in different subject area and level of students.

Demonstration method enhanced students' achievement in Basic Science better than Self-regulated Learning Strategy. However, there was no significant difference between the mean achievement scores of students taught basic science using Self-regulated Learning Strategy and those taught using demonstration method. The finding of this study disagrees with that of Cromley and Azevedo (2011) who examined the effectiveness of self-regulated learning (SRL) training in facilitating college students' learning with hypermedia in a study entitled "Does training on self-regulated learning facilitate students learning with hypermedia? The results of the study revealed that students in the SRL training condition gained a deeper understanding than the control group students when using a hypermedia environment to learn about complex science topics. The researchers concluded that students can be trained to regulate their learning with hypermedia by engaging in several key processes and mechanisms related to SRL, such as planning, monitoring and enactment of effective strategies.

It was also found that the researchers' extensive think-aloud protocols indicate that not only did the learners in the SRL training condition gain a deeper conceptual understanding, but they also more frequently deployed the SRL processes taught them to

effectively regulate their learning, and that the use of these processes led to significant increases in students' understanding of the science topic. They (students) regulated their learning by planning, (prior knowledge activation planning), meta-cognitively monitoring their cognitive system (judging their learning, feeling of knowing) and their progress toward goals, deploying effective strategies such as drawing, summarizing, taking notes, reading notes, elaborating knowledge there is surprise in the present study. It was expected that students would regulated their learning by planning, (prior knowledge activation planning), meta-cognitively monitoring their cognitive system (judging their learning, feeling of knowing) and their progress toward goals, deploying effective strategies such as drawing, summarizing, taking notes, reading notes and elaborating knowledge among others which was what was seen happening practically in the classroom, but it was not the same as indicated by Cromley and Azevedo (2011). However, demonstration method is equally an effective strategy and known to be students centred and was intentionally used as control group to enable us find out strategies that clearly stand out. By implication, self-regulated learning strategy does not stand when compared with demonstration method though from research questions and comparing pre-test with post-test, students gained substantially in SRL class.

Peer Collaboration Strategy enhanced students' achievement in Basic Science better than Self-regulated Strategy (SRL). There is a significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using Self-regulated learning strategy. As earlier explained, this result was expected following the fact that the teacher carefully planned the lesson, provided adequate time for interaction among peers, structured the task that

were given as well as allow the use of fairly familiar tasks that could have engendered coordination and use of prior knowledge. The finding from the study by Afolabi and Yusuf (2010) is in agreement with the present study. Though SRL was seen to be facilitative, students in peer collaboration class gained more knowledge in Basic Science. This is because peer collaboration strategy was equally interactive with students as active participants; the pairs of students who worked collaboratively, and both of whom made larger gains from pre-test to post-test in basic science than those who were in SRL class probably constructed knowledge together and gave positive feedback thereby giving them an edge above those in SRL.

Peer Collaboration Strategy facilitated achievement among the male students in Basic science more than the female students in the same class. However, there was no significant difference between the mean achievement scores of male and female students taught basic science using peer-collaborative learning strategy. The follow up to this finding is that peer collaboration strategy is gender friendly as it gives both male and female opportunities to learn and achieve on a near equal basis. This finding is in agreement with that of Ibe, (2008) who investigate the effect of instructional materials manipulation on breaking gender barriers on achievement of male and female students in STME in University of Nigeria Nsukka. It was revealed that no significant difference was found between the mean achievement scores of boys and girls when exposed to each of the teaching methods, that is, guided inquiry and demonstration methods. The issue here is that when a method is interactive and engaging male and female students, the differences in achievement due to gender disappears. This result however is not in agreement with Akalonu (2008) who conducted a study on the use of female friendly

curriculum materials on the achievement and interest of female and male upper basic one students. Finding showed that the achievement test scores of female students (62.54 SD =17.09) was higher than those of male students, mean test scores (47.77 SD 13.42) and the ANCOVA for the effect of FCM on achievement in Integrated science revealed a significant gender difference. It is worthy of note however that the females did better than the males in Akalonu study because female friendly curriculum was used for the study and one can hold exception to it.

Another finding of this study is that Self-regulated Learning Strategy enhanced male students' achievement in Basic Science better than for the female students in the same class. However there is no significant difference between the mean achievement scores of male and female students taught basic science using self-regulated learning strategy. This was possible because the learners in the SRL training condition gained a deeper conceptual understanding and could have also frequently deployed the SRL processes taught them to effectively regulate their learning, and that the use of these processes could have led to significant increase in students' understanding of the basic science topic among male and female students. This result however is not in agreement with that of Akalonu (2008) who found that the ANCOVA for the effect of female friendly curriculum on achievement in Integrated science on male and female students was significant; $F = 436.84$ at $p < 0.05$. The females probably did better than the males in Akalonu study because female friendly curriculum was used for the study. The present study used the normal upper basic science curriculum which appears to be balanced in content presentation to both males and females and hence there is no significant difference result.

It was also found in the study that there is no significant interaction effect of methods of instruction and gender on students' achievement in basic science. The fact that male and female students were exposed to three different strategies could have produced a resultant effect on the final achievement of all the students. When two or more independent variables are involved in a research design (in this case three), there is more to consider than simply the "main effect" of each of the independent variables (also termed "factors"). That is, the effect of one independent variable on the dependent variable of interest may not be the same at all levels of the other independent variable. Another way to put this is that the effect of one independent variable (method) may depend on the level of the other independent variables (gender).In order to find an interaction, a factorial design was involved, in which the two independent variables (method and gender) are "crossed" with one another so that there are observations at every combination of levels of the two independent variables. In this study they never crossed and this is indicated by the fact that there was no interaction effect of method and gender on students' achievement in basic science.

By implication any main effect on achievement in basic science, that is, treatment on achievement could be said to be as a result of treatment, that is the teaching strategy (peer collaboration or self-regulated or demonstration strategies) and not another factor.

CHAPTER FIVE

SUMMARY, CONCLUSION ANDRECOMMENDATIONS

5.1 Introduction

This chapter contains the summary of the entire study, conclusion, recommendations based on the findings and suggestions for further research are given

5.2 Summary

This study examined the effects of peer collaboration and self-regulated learning strategies on students' achievement in basic science among Upper Basic 2 in Makurdi Local Government Area of Benue State. The study employed non-equivalent group pre-test-post-test quasi experimental design. The population of the study was 638 upper basic school levels. The sample for this study was 128 students from six co-educational schools within Makurdi Local Government Area of Benue State since gender is a moderator variable in this study. For this purpose, five research question and six hypotheses were formulated respectively that guided the study. The instrument used for data collection was Basic Science Achievement Test (BSAT), the instrument was trial tested using Kuder-Richardson (K-R, 20) formula to determine the reliability coefficient of BSAT which was found to be 0.99.

The study was anchored on three theories namely; Jean Piaget's theory of cognitive development, Bruner's theory of learning by discovery and Vygotsky's socio-cultural theory. Concepts were reviewed which are in consonance with the problem under investigation. Descriptive statistics of means and standard deviation were used to answer all the research questions and inferential statistics of Analysis of Covariance (ANCOVA)

was used to test all the hypotheses at 0.05 significant level. The results of the study showed that,

1. Peer Collaboration Learning Strategy enhanced students' achievement in Basic Science better than Demonstration method. There is a significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using demonstration method.
2. Demonstration method enhanced students' achievement in Basic Science better than self-regulated strategy. However, there is no significant difference between the mean achievement scores of students taught basic science using self-regulated learning strategy and those taught using Demonstration method.
3. Peer Collaboration Strategy enhanced students' achievement in Basic Science better than Self -regulated strategy. There is a significant difference between the mean achievement scores of students taught basic science using peer-collaborative learning strategy and those taught using self-regulated learning strategy.
4. Peer Collaboration Strategy facilitated achievement more among the male students in Basic science compared with the female students in the same class. However, there is no significant difference between the mean achievement scores of male and female students taught basic science using peer-collaborative learning strategy.
5. Self -regulated Learning Strategy enhanced male students' achievement in Basic Science better than for the female students in the same class. However there is no significant difference between the mean achievement scores of male and female students taught basic science using self-regulated learning strategy.

6. There is no significant interaction effect of methods of instruction and gender on students' achievement in basic science.

5.3 Conclusion

In conclusion, Peer Collaboration Learning Strategy enhanced significantly higher achievement scores in basic science than Self-regulated Learning Strategy and demonstration method. This implies that the use of Peer Collaboration Learning Strategy as a teaching strategy is more effective in fostering and stimulating students learning and high achievement in basic science and other subjects at large. Students taught basic science using Peer Collaboration Learning Strategy achieved better than those taught using demonstration methods. Also demonstration method enhanced student's achievement in basic science better than those taught using Self-regulated Learning Strategy.

The researcher concluded that students can be trained to regulate their learning by engaging on several key processes and mechanisms related to Self-regulated Learning Strategy such as planning, goal setting, monitoring and enactment of effective strategies. Furthermore, Peer collaboration learning and Self-regulated learning instructional strategies facilitated achievement slightly among the male students in Basic science compared with the female students in the same class, although the difference between the mean achievement scores of male and female students taught basic science using both Peer Collaboration Learning Strategy and Self-regulated Learning Strategy was not significant

5.4 Recommendations

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

1. The students were trained in the use of Peer collaborative learning strategy; however basic science teachers should not only teach the students the subject matter but also allow them to interact with one another, so that they (students) can take charge of how they can learn. This can foster confidence in the students and enhance their achievement in science and basic science in particular.
2. The school administrators should allow and provide adequately for the basic science teachers to take refresher courses in novel instructional strategy such as Peer Collaboration Learning Strategy to enhance students' achievement in basic science. Educational stakeholder(Federal and State ministries of Education, professional bodies such as Science Teachers Association of Nigeria (STAN), should organise workshops/seminars on the use of Peer collaborative learning strategy and demonstration method for basic science teachers, so that they can master the principles behind these strategies. The ministry should provide adequately for the expenses of the workshops/seminars.
3. Faculties of Education and Colleges of Education should organise seminar and in-service courses on peer collaborative learning strategy and demonstration method for serving teachers so that they can have adequate knowledge about the strategies.
4. There was no gender disparity in the mean achievement scores of the students in both peer collaboration and Self-regulated Learning Strategy group. Basic science teachers should always employ teaching strategies that allow both male and female students to be actively engaged with the learning materials for meaningful learning to occur.

5. For enhanced performance by both males and females(gender performances equality) in basic science achievement, teachers should be encourage to employ peer collaboration as this enhances best achievement compared to Self-regulated Learning and demonstration instructional strategies across the gender divide.

5.5 Limitations

The following limitations were observed regarding this study that may hold back the extent of applicability and general ability of the findings in this study.

1. The intent of the study was to ascertain the effect of Peer collaboration and Self-regulated learning strategies on student's achievement in basic science. But the basic science curriculum content was limited to few topics instead of the entire Basic science curriculum content
2. The Basic Science Achievement Test (BSAT) reflected cognitive ability tasks on all lower order cognitive ability, but limited or less at the higher cognitive ability tasks.

5.6 Suggestion for Further Studies

This study was carried out on effect of Peer collaboration learning strategy and Self-regulated Learning Strategy on students achievement in basic science among upper basic school level, the researcher is of the opinion that,

1. The study concentrated only on basic science, further study should be carried out on other field of science courses such as biology, chemistry, physics and mathematics
2. The study could be replicated in a different location within and outside Benue State

5.7 Contribution to Knowledge

The following are the contributions of the study to knowledge:

The study established that, peer collaboration learning strategy enhance students achievement in basic science best among the three instructional strategies studied for teaching and learning of basic science at the upper basic school levels. It is also superior to both Self-regulated Learning Strategy and demonstration method.

Another striking thing in these findings that contributes to the existing knowledge is that, demonstration method which is a conventional method used as a control group enhanced students achievement in basic science more than self-regulated teaching which is a learning strategy.

Another contribution of the findings to knowledge is the issue of gender, Gender does not influence achievement in basic science irrespective of the method of instructions among the three strategies that is; peer collaboration learning strategy, self-regulated learning and demonstration method; as it prove to be non-discriminatory as they are gender friendly.

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APPENDICES

APPENDIX A

Letter to SUBEB and Analysis of BECE/JSCE Results

Department of Curriculum and Teaching,
Benue State University, Makurdi.
28/11/14

The Executive Secretary,
Benue State Examination Board,
Makurdi.

Sir,

Request for BECE/JSSCE Results

I humbly write to seek for permission to obtain result of JSSCE/BECE of upper basic 2 (UB2) students for 2008-2014 academic session.

I am a post graduate student of Benue State University in the Department of Curriculum and Teaching. I am carrying out a research work on Effect of Peer Collaboration and Self-Regulated Learning Strategies on achievement in Basic Science among upper basic 2 (UB2) students in Makurdi Local Government.

The information will be used strictly for research purpose.

I will be very grateful if my request is granted.

Yours faithfully,

Jirgba M. Christy

Statistics of Graduating Students Achievement at Credit Level in Basic Science at BECE/JSCE Grades for 2008-2014.

Year	No of candidates	No/ Percentage Credit pass	No/percentage non-credit .pass
2008	3654	5829**(43.3%)**	2072(**56.7%)**
2009	4541	1894**(41.7%)**	2647**(58.3%)**
2010	5043	1594**(31.6%)**	3449**(68.4%)**
2011	6863	2629**(38.3%)**	4234**(61.7%)**
2012	7146	2794**(39.1%)**	4352**(60.9%)**
2013	7234	2416**(33.4%)**	4818**(66.6%)**
2014	6797	2549**(37.5%)**	4248**(62.5%)**

Source: Benue State Examination Board (BSEB) Makurdi. (2008-2014)

APPENDIX B

Table of specification of Basic Science Achievement Test. (BSAT)

Contents	Knowledge (K) 35%	Comprehension (Cp) 25%	Application (App) 17.5%	Analysis (An) 10%	Synthesis (Syn) 7.5%	Evaluation (Eva) 5%	Total 100%
Human digestive system (52.5%)	**4**(1, 4, 11, 13,)	**7**(5, 10,12,8, 14,16, 20)	**3**(6,18,19)	**2**(2,15,)	**2**(7,17)	**2**(3,9)	**20**
Drug Abuse (12.5%)	**2**(29,30)	**1**(33)	**1**(32)	**1**(31)	-	-	**5**
Element Compound and mixture (17.5%)	**3**(24,25,23)	**3**(21,27,,22)	**1**(28)	-	**1**(26)	-	**8**
Disease Vector (17.5%)	**2**(34,36)	**2**(37,39)	**2**(38,40)	**1**(35)	-	-	**7**
Total	11	13	7	4	3	2	40

APPENDIX C

VALIDATION OF INSTRUMENT (BSAT)

Department of Curriculum and Teaching,
Benue State University,
Makurdi.

28/11/15

Dear Sir/Ma,

VALIDATION OF INSTRUMENT (BSAT)

I am a Post-graduate student of the Department of Curriculum and Teaching currently proposing a research study titled: Effect of peer collaboration and Self-regulated Learning Strategy on achievement in Basic Science among upper basic 2 (UB2) students in MakurdiLocal Government Kindly **validate** the attached Basic Science Achievement Test Questionnaire please. Attached is a copy of the research purpose, questions and hypotheses for your guidance.

Yours,

Jirgba, M.C

VALIDATORS REPORT

1. Name.... Professor Nicholas A. ADA

Area of specialization.... Science Education (Chemistry)

Address.... FAC. of Edu. BSU Makurdi

Comments on BSAT.... The items on the instrument reflected Content Validity. The face validity was improved by a suggestion to space out the items. The language was very clear & within the cognitive demand of the students

25/6/16 Comments on lesson plans.... The lesson plan was prepared in line with the format showing stepwise presentation.

General comments.... Grammatical errors were corrected and candidate was taken through each steps to focus the attention on what should be done

2. Name.... Dr OKwara Kalu OKwara

Area of specialization.... Science Education (Biology)

Address.... College of Agric And Science Education, UAM.

Comments on BSAT.... Redundant items have be expunged from the instrument to meet the intended purpose of the study. Provide a table of Specification based on Bloom's Taxonomy for BSAT.

Comments on lesson plans.... Lesson plan was systematic in line with presentation in the classroom. However note errors on Behavioural objectives.

General comments.... Grammatical errors have been affected and candidate showed great commitment to finetune her instruments.

18/07/16

3. Name: Dr. Benjamin O. Abakpa

Area of specialization: Mathematics Education.

Address: Science Education Dept, U.A.N.

Comments on BSAT: The items reflect the scope of study and achieve the objective of study. However, minor grammatical errors were suggested for correction.

Comments on lesson plans: The lesson plans are sufficient. However, the subtopic: Progressive Evaluation should be deleted from the table.

General comments: The instruments are quite satisfactory for the study.

Dr B.O Abakpa
22/07/2016.

APPENDIX D

Letters for permission to school Principals, BSAT Questionnaire and Marking Scheme

Department of Curriculum and Teaching,

Faculty of Education,

Benue State University,

Makurdi.

26/1/2015.

The Principal,

……

…….

…….

Sir,

PERMISSION TO CARRYOUT RESEARCH WORK

I am a post-graduate (PhD) student of science education in the Department of Curriculum and Teaching, Benue State University Makurdi. I write to request for permission to carry out an experiment with the Upper basic 2 (UB2) students in your school on the effect of Peer collaboration and self-regulated learning on student achievement in basic science in Makurdi Local Government

The research work is part of the on-going efforts aimed at improving the teaching/ learning ofBasic science in our schools.

Your school is one among the schools sampled for the research study in Makurdi Local Government.

This work is purely for research purpose and not for public consumption.

With highest regards, I remain,

Jirgba, M.C

BASIC SCIENCE ACHIEVEMENT TEST (BSAT) PRE -BSAT

SECTION A: Demographic Information

Pre-Test /Post-Test Participant

Name of the school……

Group…….Age……..Sex……..

SECTION B: Objectives.

Instruction: ***Attempt all questions in this section.***

1. Protein digestion begins in the …….

   (a) Duodenum (b) mouth (c) stomach (d) ileum

2. Which of the following is not a digestive enzyme?

   (a) Lipase (b) pepsin (c) ptyalin (d) maltose

3. The digestion of carbohydrate starts in the …

   (a) Mouth (b) stomach (c) duodenum (d) rectum

4. Carbohydrate are absorbed into the body in the form…..

   (a)amino acid (b)glycerol (c)complex sugar (d) glucose

5. The end product of digestion of protein is ……..

   (a) Amino acid (b) vitamins(c) glucose (d) glycerol

6. Partially digested food ready to leave the stomach is called

   (a) curd (b) paste (c) chyme (d) sugar

7. To which class of food would items like meat, fish milk, beans, belong

   (a) Fats (b)carbohydrate (c) vitamins (d) protein

8. The part of organs system located just before the anus is the

   (a) appendix(b) rectum(c) Pancreas (d) large intestine

9. The undigested food substance which passes out through the anus is called

   (a) Urine (b) faeces (c) sweat (d) physics

10. Food gets into our blood stream through a special structure called

    (a) Villi (b) stomach (c) gullet (d) veins

11. What's the name of the secretion from the liver ……

    (a) Bladder (b) gastric juice (c) bile (d) fats

12. The end-product of carbohydrate digestion is…

    (a) Sugar (b) protein(c) Fatty acid (d) bile

13. Excess sugar can be stored in the body in form of…

    (a) Glycerol (b) glycogen (c) amino acid (d) fatty acids

14. The gastric juice is located in the …….

    (a) Mouth (b) ileum(c)stomach (d)intestine

15. Which of the following is not a component of a balance diet?....

    (a) carbohydrate (b)protein (c) vitamins and minerals (d)pepsin

16. Which of the following is part of large intestine

    (a) colon(b) mouth (c)fundus(d) ileum

17. What kind of enzyme contain in salivary gland…

    (a) bile (b)ptyalin (c) liver (d)trypsin

18. What main diet would you recommend for a body suffering from obesity

    (a) yam &beans (b) rice &plantain (c) vegetable & beans (d) eba&melon soup

19. The process whereby undigested food are removed from the body from time to time through anus is called ……..

    (a) digestion (b) ingestion (c)egestion (d)absorption

20. Alimentary canal can be described as ----

(a)a tube that gives the body shape(b)a tube in which food passes through an animal body(c) the energy bank of the body (d) tube in which food is broken down in the body

21. Which of the following food items is a major source of protein ……..

(a) plantain(b)yoghurt (c) yam (d)orange

22. ……. Can be separated without a chemical reaction……..

(a) compound (b)element (c) mixture (d) atom

23. An example of mixture is ……

(a) fruit salad (b) oxygen(c)salt(d)rust

24. Which of the following is chemical change?

(a) freezing (b) burning (c) melting (d)evaporation

25. Which of these is a compound……..

(a) gold (b) iron (c) fruit salad (d) salt

26. People often hang their clothes out to dry, this is an example of …..

(a) freezing (b) melting (c) evaporation (d) condensation

27. All of these are examples of mixture except ……...

(a) soil (b)air(c) urine (d) soap

28. A substance that is made up of only one kind of atom is called

(a) element(b) gas (c)compounds (d) mixture

29. ……. Is a substance that changes the way the body gap works

(a) element (b) drug (c) atom (d)molecule

30. Over dependence /overuse of prescribed drugs is

(a) drug use (b) drug mess (c)drug abuse (d) smoking

31. All are examples of effect of drug abuse except

(a) damage to the brain (b) damage liver (c) damage lungs (d) make one to be wise

32. One of the agencies that is responsible for implementing health policies is…….

(a)NADAC (b)NAFDAC(c)DACNAF(d)NAFCD

33. The full meaning of NDLEA

(a) Nigeria drug law enforcement agency (b) national drug law empowerment agency (c) national drug law enforcement agency (d) national drug law enforcement agenda

34. Which of the following is not a disease vector

(a)anopheles mosquitoes(b) tse- tse fly (c) bat (d) butterfly

35. Ebola fever is transmitted through the following vectors except ……..

(a) rabbit (b) bat(c) monkey (d) chimpanzee

36. Diabetes is a sickness caused by.....

(a) excess fats in the body (b) excess sugar in the body (c) excess protein in the body(d) excess urine in the body

37. Diseases that can be transmitted from organism to another is called ……

(a) non-communicable disease (b) communicable disease (c) pathogens (d)cancer

38. The following are diseases that can be contacted through touch (skin-skin, skin-clothing) except

(a) eczema (b) ringworm(c)Ebola fever(d)typhoid fever

39. The following are ways of preventing disease except…….

(a) proper sanitation (b) proper education (c)immunization and hand sanitizer (d) vector

40. The deadly disease that have an incubation period of 21 days?

(a) tuberculosis (b) typhoid fever (c) cholera (d) Ebola fever

BASIC SCIENCE ACHIEVEMENT TEST (BSAT)POST -BSAT

SECTION A: Demographic Information

Pre-Test/Post-TestParticipant

Name of the school……

Group…….Age……..Sex……..

SECTION B: Objectives.

Instruction: ***Attempt all questions in this section.***

1) What's the name of the secretion from the liver ……

   (a) bladder (b) gastric juice (c)bile (d) fats

2) The end-product of carbohydrate digestion is…

   (a)sugar(b) protein (c) fatty acid (d) bile .

3) Excess sugar can be stored in the body in form of…

   (a) glycerol (b)glycogen (c)amino acid (d) fatty acids.

4) The gastric juice is located in the …….

   (a) mouth (b)ileum(c)stomach (d)intestine.

5) Which of the following is not a component of a balance diet?....

   (a) carbohydrate (b)protein (c) vitamins and minerals (d)pepsin.

6) Which of the following is part of large intestine

   (a) colon (b) mouth (c) fundus(d) ileum.

7) What kind of enzymes contained in salivary gland…

   (a) Bile (b) ptyalin (c) liver (d) trypsin.

8) What main diet would you recommend for a body suffering from obesity

   (a) yam &beans (b) rice & plantain (c) vegetable & beans (d) eba & melon soup?

9) The process whereby undigested food are removed from the body from time to time through anus is called ……..

   (a) digestion (b) ingestion (c)egestion (d)absorption.

10) Alimentary canal can be described as ----

(a)a tube that gives the body shape(b)a tube in which food passes through an animal body(c) the energy bank of the body (d) tube in which food is broken down in the body.

11) Which of the following food items is a major source of protein ……..

(a) plantain(b)yoghurt (c) yam (d)orange.

12) ……. Can be separated without a chemical reaction……..

(a) Compound (b)element (c) mixture (d) atom.

13) An example of mixture is ……

(a) fruit salad (b) oxygen(c)salt(d)rust.

14) Which of the following is chemical change?

(a) freezing (b) burning (c) melting (d)evaporation

15) Which of these is a compound……..

(a) gold (b) iron (c) fruit salad (d) salt.

16) People often hang their clothes out to dry, This is an example of …..

(a) freezing (b) melting (c) evaporation (d) condensation.

17) All of these are examples of mixture except ……...

(a) soil (b)air(c) urine (d) soap.

18) A substance that is made up of only one kind of atom is called

(a) element (b) gas (c)compounds (d) mixture.

19) ……. Is a substance that changes the way the body gap works

(a) element (b) drug (c) atom (d)molecule.

20) Over dependence /overuse of prescribed drugs is

(a) drug use (b) drug mess (c)drug abuse (d) smoking.

21) All are examples of effect of drug abuse except

(a) damage to the brain (b) damage liver (c) damage lungs (d) make one to be wise.

22) One of the agencies that is responsible for implementing health policies is……

.(a) NADAC (b) NAFDAC (c) DACNAF (d) NAFCDA.

23) The full meaning of NDLEA

(a) Nigeria drug law enforcement agency (b) national drug law empowerment agency (c) national drug law enforcement agency (d) national drug law enforcement agenda

24) Which of the following is not a disease vector

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25) Ebola fever is transmitted through the following vectors except ……..

(a) rabbit (b) bat (c) monkey (d) chimpanzee.

26) Diabetes is a sickness caused by.....

(a) excess fats in the body (b) excess sugar in the body (c) excess protein in the body(d) excess urine in the body.

27) Diseases that can be transmitted from organism to another is called ……

(a) non-communicable disease (b) communicable disease (c) pathogens (d)cancer.

28) The following are diseases that can be contacted through touch (skin-skin, skin-clothing) except

(a) eczema (b) ringworm(c)Ebola fever(d)typhoid fever.

29) The following are ways of preventing disease except…….

(a) proper sanitation (b) proper education (c)immunization and hand sanitizer (d) vector.

30) The deadly disease that have an incubation period of 21 days?

(a) Tuberculosis (b) typhoid fever (c) cholera (d) Ebola fever.

31) Protein digestion begins in the …….

(a) Duodenum (b) mouth (c) stomach (d) ileum.

32) Which of the following is not a digestive enzyme?

(a) Lipase (b) pepsin (c) ptyalin (d) maltose.

33) The digestion of carbohydrate starts in the …

(a) mouth (b) stomach (c) duodenum (d) rectum.

34) Carbohydrates are absorbed into the body in the form…..

(a) amino acid (b)glycerol (c)complex sugar (d) glucose.

35) The end product of digestion of protein is ……..

(a) amino acid (b)vitamins(c) glucose (d) glycerol

36) Partially digested food ready to leave the stomach is called

(a)curd (b) paste (c) chyme (d) sugar.

37) To which class of food would items like meat, fish milk, beans, belong

(a) fats (b)carbohydrate (c) vitamins (d) protein.

38) The part of organs system located just before the anus is the

(a) appendix(b) rectum (c) pancreas (d) large intestine.

39) The undigested food substance which passes out through the anus iscalled ……(a) urine (b) feaces (c)sweat (d) physic.

40) Food gets into our blood stream through a special structure called

(a)villi (b) stomach (c) gullet(d)veins.

MARKING SCHEME FOR PILOT STUDY

MARKING SCHEME FOR PRE-TEST

1 B	14 C	27 D
2 D	15 D	28 A
3 A	16 A	29 C
4 D	17 B	30 C
5 A	18 C	31 D
6 C	19 C	32 B
7 D	20 B	33 C
8 B	21 B	34 C
9 C	22 C	35 A
10 A	23 A	36 B
11 B	24 B	37 B
12 A	25 D	38 D
13 B	26 C	39 D
		40 D

MARKING SCHEME FOR POST-TEST

1 B	14 B	27 B
2 A	15 D	28 D
3 B	16 C	29 D
4 C	17 D	30 D
5 D	18 A	31 B
6 A	19 B	32 D
7 B	20 C	33 A
8 C	21 D	34 D
9 C	22 B	35 A
10 B	23 C	36 C
11 B	24 C	37 D
12 C	25 A	38 B
13 A	26 B	39 C
		40 A

APPENDIX E:

LESSON PLANS

A. LESSON PLAN FOR EXPERIMENTAL GROUP1 (EG_1) PEER COLLABORATION.

CLASS – Upper basic 2 (UB2)
SUBJECT – Basic science
TOPIC- Metabolism of food in human body
SUBTOPIC – Digestion of food
TIME- 80mins
BEHAVIOUR OBJECTIVES

By the end of the lesson, students should able to;

i. Define the term digestion.

ii. Mention five organs of digestive system and state the functions of each.

iii. What are excess food is stored in the body?

iv. What are the problems associated with excess food stored in the body

v. Describe the process of absorption of food materials in the body.

vi. Match the following organs (mouth, stomach and small intestine) with their juices.

Previous Knowledge: students had background knowledge about how food is processed in the body

Instruction material: Diagrammatic representation human digestive system

Method of teaching: peer collaboration learning strategy.

Introduction: The teacher starts by asking the students questions about what they have eaten in the morning as breakfast and what are the process involved

Presentation and Development

facts to be taught	Time Mins	Teachers activities	Students activities
Step`1 Definition of concept digestion	5	The teacher guides the students to define the term digestion such as the process by which ingested food material are broken down into smaller particles which can be absorbed in the body	Students try to define digestion
Step 2 Display of human Digestive system	5	The teacher displays a chart of digestive system on the wall for the students to see	Students view the chart and note the position of each organ as it leads to one another
Step 3 Collaborative brain storming, organs of digestive system and their functions	20	Teachers share the students into various groups of four students each to share ideas among themselves based on the facts to be taught	Students try to list all the organs of digestive system and their functions in their work sheet as they brainstorms and discuss together to come out with grip ideas
Step4 Digestive juices and their location, absorption and storage of food	20	Guides students to identify the location of each digestive juices in each organ as well as describing the processes of absorption and storage of food materials in the body in their various groups as they share ideas together	Students write out their responses to the questions on the worksheet, what they think is correct in their various groups
Step 5 Problems associated with food storage in	10	Teachers directs students to identify the problems of food storage in the body, they were encouraged to put heads together and	Students attempt to list some of the problems associated with food storage in the body

the body		come out with facts about the problems	
Presentation of group task	15	Once students are satisfied with t heir group and time management, teachers directs them to return to their respective sits for presentations to t he entire class	Students move to their sits. Each group sends a representative at the end of each presentation, students ask questions and discuss freely with the teacher guiding them
Step 6 Evaluation	5	i. Briefly explain the term digestion. ii. Mention five organs of digestive system and state the functions of each. iii. In what forms is excess food stored in the body. iv. What are the problems associated with food storage in the body v. Describe the process of absorption of food materials in the body. vi. Match the following organs (mouth, stomach and small intestine)with their juices.	Students asks their questions and also answer the teachers questions

Conclusion and summary: the teacher concludes her lesson by going over the salient points

Assignment: Draw and label the human digestive system and indicate with an arrow the flow of food and submit next lesson

2)

LESSON PLAN: Peer collaboration

CLASS: upper basic 2 (UB2)

SUBJECT: BASIC SCIENCE

TOPIC: ELEMENTS, COMPOUND AND MIXTURE

DURATION: Double period (80 MINS EACH)

BEHAVIOURAL/OBJECTIVES: by the end of the lesson, students should be able to

a. Distinguish between a compound and a mixture
b. Explain why a compound is a chemical change and not a physical change
c. In a tabular form, state three properties of compound and a mixture
d. Write out the constituents of a mixture
e. Identify compound and their component elements
f. Define an element.

Previous Knowledge: Students had background knowledge about element, compound and mixture in their UB2 class previously

Instructional materials: Salt, mixture of iron fillings and sand

Method of teaching: peer collaboration learning strategy.

Introduction: The teachers ask the student to mention the name of salt used in our food

Presentation

Facts to be taught	Time Mins	Teachers activities	Students activities
Step 1 Element compound and mixture	10	Teacher guide the students to define the following terms elements, compound and mixtures also to identify salt used in our cooking foods	Students attempt to define the following terms, as well as identifying common salt used in cooking food
Step 2 Brain storming. Differentiate between compound and mixture in a tabular form	20	Teacher group the students into various groups of four students each and give them worksheet to answer the following tasks / questions group by group as they share ideas, working on the worksheet.	Students share ideas, brainstorm, put heads together to come out with expected answers in a tabular form
Step3 Components element of compound constituent element of mixture state which is chemical or physical change	20	Teacher guides the students to mention the component elements of compound and the constituents of mixture as well as stating which is chemical and physical change	Students attempt to mention the components of compound and constituents of mixture and try to identify physical and chemical change among them.
Step 4 Presentation of group task	30	Teacher directs students to go back to their sits for presentation of learning task to the entire class, teacher gives room for questioning for further clarification of lesson, receive questions from students and highlight salient points .	Students move back to their sits, each group is represented. At the end of each presentation, students ask questions and discuss freely with t he teacher guiding them.

Evaluation: The teacher evaluates the students by asking them oral questions group by group to test the understanding of the lesson based on the stated objectives as follows.

a. Distinguish between a compound and a mixture
b. Explain why a compound is a chemical change and not a physical change
c. In a tabular form, state three properties of compound and a mixture
d. Write out the constituents of a mixture
e. Identify compound and their component elements
f. Define an element

Assignment: Read about method of separation of mixture and prepare to answer questions next lesson.

3)

LESSON PLAN: Peer collaboration

CLASS – UB2

SUBJECT- Basic Science

TOPIC – Drug Abuse

TIME – Double Period (80 Mins)

BEHAVIOURAL OBJECTIVE:

By the end of the lesson, student should be able to

a. Define the term drug
b. Distinguish between drug and drug abuse
c. Discuss the benefits of drugs to human being
d. Explain the harmful effect of drug abuse in mankind
e. State how drug abuse can be prevented
f. Mention the governmental agencies that regulates and control drug abuse

Previous Knowledge: Students have seen and taken drugs administered to them in the hospital.

Instructional materials: Paracetamol, cigarette etc.

Method of teaching: peer collaboration learning strategy

Introduction: The teacher introduces her lesson by asking the student what kind of drugs they take when sick.

Presentation

Step i: The teacher displays the sample of different types of drugs on the tables for the student to come out group by group and have a look at them

Step ii: The teacher shares the student into group of four students each and distributed to work sheet each member of the group to work on as they share ideas based on the following questions

a. Define the term drug
b. Distinguish between drug and drug abuse
c. Discuss the benefits of drugs to human being
d. Explain the harmful effect of drug abuse in mankind
e. State how drug abuse can be prevented
f. Mention the governmental agencies that regulates and control drug abuse

Step iii: After which, the leader of each group will come out and read what they have written, while the teacher acts as moderator or guide and the rest of the class listen as they make their

Presentation

Facts to be taught	Time Mins	Teachers activities	Students activities
Step 1 Introduction of concept drug	5	the teacher guides the students to define the term drug as a substance that changes the way the body works.	Students try to define the term drug
Step 2 Display of chart containing various samples of drugs. Collaborative brainstorming	10	Teacher displays chart containing various drugs on the wall for the students to see and identify simple and harmful drugs.	Students take a look at various drugs and try to point out the harmful ones.
Step 3 Distinguish between drug and drug abuse state the effect of drug abuse	20	Teacher splits students into various groups of four each, ask them to assume roles of leader and time keeper. Teacher asks students to compare individual answers and collectively brainstorm to come out with group ideas on all questions raised.	Students move to different groups and assume different roles to themselves as agreed by members. They brainstorm and come up with the answers they think is correct.
Step 4 Control/preventive of drug abuse	20	Teacher encourage the students to write out their answers on the worksheet given to them individually as they share ideas or brainstorm . instructs groups to be independent as possible because no two groups can think the same way.	Students are expected to come up with a list comprising of all the answers to the questions that they think is correct in each group to present as agreed upon by the entire group.

Step 5 Group presentation	25	Teacher disengage students from their groupings and appoints a presenter to come out and make their presentation. She/ he serves as a facilitator	Students move to their respective sits, select their representatives while members watch, listen and make contributions at the end of each presentation.

Evaluation: The teacher evaluates the students by asking them the following questions

a. Define the term drug
b. Distinguish between drug and drug abuse
c. Discuss the benefits of drugs to human being
d. Explain the harmful effect of drug abuse in mankind
e. State how drug abuse can be prevented
f. Mention the governmental agencies that regulates and control drug abuse

Conclusion / summary: the teacher concludes her lesson by reminding the students once more about the harmful effect of drug abuse.

Assignment: i**.** list five drugs you know that are harmful to human beings

iii. Give the full meaning of NAFDAC AND NDLEA

4)

LESSON PLAN: Peer collaboration

CLASS upper basic 2 (UB2)

SUBJECT – Basic science

TOPIC – Diseases

TIME- double period (80mins)

Behavioural Objectives: by the end of the lesson, students, should be able to

a. define the term diseases
b. discuss very type of diseases
c. describe the mode of transfer of diseases
d. List common examples of disease vectors
e. Explain ways by which disease can be prevented and controlled
f. Mention two roles played by sanitation and education in the control and prevention of disease

Previous / knowledge: Student had an experience of being sick or infected with the diseases

Instructional materials: Textbook showing infected persons and a life cycle of mosquito

Method of teaching: Peer collaboration learning strategy (PCLS)

Introduction: The teacher introduce her lesson by asking the student whether, they have ever fall sick in one time or the other

Presentation

Facts to be taught	Time Mins	Teachers activities	Students activities
Step 1 Word disease	5	Teacher guides the students to explain the term disease as a departure from normal state of health.	Students attempt to define the term disease
Step 2 Display of chart showing infected people and a life cycle of mosquito	5	Teacher asks the students to identify who is a sick person among the people showing on the chart and how do sick people behaved	Students identify how sick people look like and their behaviour
Step 3 Collaborative brainstorming on types of disease and their mode of transmission	30	Teacher splits students into groups of four, each with work sheets, asks them to assume roles of a leader and time keeper. Teacher instructs students to write their responses on the worksheet what they think is the correct answers individually and collectively, brainstorm, share ideas or put heads together and come out with group ideas on all the questions raised.	Students move to different groups and assume role to themselves as agreed by members. Students spread out their individually written ideas and answers to all the questions students brainstorm and write out clearly on the worksheet, types of diseases and their modes of transmission. At this stage they are expected to harmonized their answers and come out with the final answers.

Step 4 Prevention and control and the roles played by sanitation and education	10	Guides students to state ways of preventing and controlling diseases and the role played by sanitation and education.	Students share ideas and come out with the agreed answers in their various groups.
Step 5 Group presentation	10	Directs students to move back to their various sit and ask them to select a presenter to represent them in their various groups. The teacher act as a facilitator	Students listen, contribute and criticized at the end of each presentation.
Step 6 Group presentation	20	The teacher calls the leader of each group to present what they jointly put together with teacher moderating their answers.	The rest of the students listen as they make their presentation one after another
Step 7 Elucidation	5	After every body has presented, the students are allow to ask questions from areas they do not understand for further clarification.	Students ask questions and give responses to the questions.

Evaluation : Evaluates the students by asking them oral questions based on stated objectives to get the feedback concerning the lesson such as :

a. define the term diseases

b. discuss very type of diseases

c. describe the mode of transfer of diseases

d. List common examples of disease vectors

e. Explain ways by which disease can be prevented and controlled

f. what are the roles played sanitation and education in the control and prevention of disease

Conclusion / summary: The teacher summarize her lesson by reminding the students not to catch up with any diseases nor spread it, but to keep themselves and environment clean and free from germs.

Assignment: Read about immunization and prepare to answer questions in the next lesson

B. LESSON PLAN FOR EXPERIMENTAL GROUP 2 (EG_2) SELF-REGULATED

CLASS – UB2

SUBJECT – Basic science

TOPIC- Metabolism of food in human body

SUBTOPIC – Digestion of food

TIME- double period (80mins each)

BEHAVIOURAL OBJECTIVES

By the end of the lesson, student should able to;

i. Briefly explain the term digestion.
ii. Mention five organs of digestive system and state the functions of each.
iii. Excess food stored in the body in the form of what?
iv. What are the problems associated with excess food stored in the body
v. Describe the process of absorption of food materials in the body.
vi. Match the following organs (mouth, stomach and small intestine)with their juices

Previous Knowledge: Student had background knowledge about how food is processed in the body

Instruction material: Chart showing human digestive system

Method Of Teaching: self- regulated learning strategy

Introduction: The teacher starts by asking the students questions of what they have eaten in the morning as breakfast and what are the process involved

Presentation and Development

Facts to be taught	Time Mins.	Teachers activities	Students activities
Step 1 Introduction of concept digestive system	5	The teacher guides the students to define the term digestion such as the process by ingested food material are broken down into smaller particles which can be absorbed in the body	Students try to define digestion
Step 2 Digestive system chart	5	The teacher display digestive system chart on the wall for the students to see	Students view the chart and note the position of each organ as it leads to one another
Step 3 List organs of digestive system and their functions	10	The teacher shares work sheet to the students and tell them not to share idea with any one but to read carefully over and over following the SRL guides of comprehending the task, summarizing rehearsing to give answers to the questions.	Students try to list all the organs of digestive system and their functions individually without sharing ideas with any students
Step 4 Digestive juice and their location. Absorption and storage of food in the body	15	Students are to identify the location of each digestive juice in each organ as well as describing the process of absorption and storage of food materials in the body individually on their worksheet	Students write out their responses to the questions. What they think is correct on their worksheet individually as they read over and over and comprehend.
Step 5 Problems associated with food storage in the body	20	Teacher directs students to identify the problems of food storage in the body. They were encouraged to study carefully the materials provided and give the correct answers to the questions	Students attempts to list problems associated with food storage in the body individually following the steps involved in the SRL of studying comprehending, rehearsing, summarizing self-monitoring,

Step 6 Presentation of individual task	20	Students presented their result individually	Students lilsten, contribute and ask questions
Step 7 Evaluation	5	Teacher gives the students room to ask questions and evaluate them with the following questions i. Briefly explain the term digestion. ii. Mention five organs of digestive system and state the functions of each. iii. In what forms is excess food stored in the body. iv. What are the problems associated with food storage in the body v. Describe the process of absorption of food materials in the body. Match the following organs (mouth, stomach and small intestine)	Students ask their questions and also answer the teachers questions

Assignment: Draw and label digestive system and indicate with an arrow the flow of food and submit next lesson

6) LESSON PLAN: Self-regulated

CLASS: upper basic 2 (UB2)

SUBJECT: Basic Science

TOPIC: Elements, Compound and Mixture

DURATION: Double period (80 Minutes)

BEHAVIOURAL OBJECTIVES: By the end of the lesson, students should be able to

a. Define an element
b. Distinguish between a compound and a mixture
c. Explain why a compound is a chemical change and not a physical change
d. In a tabular form, state three properties of compound and a mixture
e. Write out the constituents of a mixture
f. Identify compound and their component elements

Previous Knowledge: Students had background knowledge about element compound ans mixture in their UB2 class previously

Instructional materials: Salt, mixture of irony filling, sand and magnet

Method of Teaching: Self-regulated Learning Strategy

Introduction: The teacher asks the students to mention the name of salt used in our food

Presentation

Facts to be taught	Time Mins	Teachers activities	Students activities
Step 1 Element compound and mixture	10	Teacher leads the students to define the following terms, element compound and mixtures with examples, she urge them to list the components element of common salt i.e element of sodium(Na) and chloride (cl)to form sodium chloride (Nacl)	Students attempt to define the terms, with giving example and also identify common salt used in cooking.
Step 2 Differentiate between compound and mixture in a tabular form and give reason why compound are chemical change	20	The teacher distributes the worksheet to individual students in their intact class, ask them to differentiate between compound and mixture on their worksheet without looking into another person's work, but to use the guide of self- regulated learning like reading over and over to comprehend materials and write the correct answers to the task provided.	Students study the materials carefully comprehend rehearse to come out with expected answers.
Step 3 Compound and their component elements	15	The teacher encourages the students to read carefully using their initiative to think, comprehend and rehearse to come out with the required activities	Students are given time to write out their responses on the worksheet what they think is correct individually.
Step 4 Constituents of mixture	10	The teacher urges the student to work individually without sharing ideas with any one	Students work independently to achieve the stated goals
Step 5 Elicitation of ideas	20	. The teacher allows the students to present their findings / results individually while the teacher act as a guide.	Students listen, contribute and ask questions where necessary for further clarification

Evaluation: she evaluate the students by asking them oral question group by group to test the understand of the lesson based on the state objectives. 5min

a. Define an element
b. Distinguish between a compound and a mixture
c. Explain why a compound is a chemical change and not a physical change
d. In a tabular form, state three properties of compound and a mixture
e. Write out the constituents of a mixture
f. Identify compound and their component elements

Conclusion/ summary: the teacher concludes her lesson by summarizing the key points in the lesson objective.

Assignment: Read about method of separation of mixtureand prepare to answer question in the next lesson

7)

LESSON PLAN: Self-regulated

CLASS – upper basic 2 (UB2)

SUBJECT- Basic science

TOPIC – Drug abuse

TIME – Double period (80 minutes)

BEHVIOURAL OBJECTIVES

By the end of the lesson, student should be able to

a. Define the term drug
b. Distinguish between drug and drug abuse
c. Discuss the benefits of drugs to human being
d. Explain the harmful effect of drug abuse in mankind
e. State how drug abuse can be prevented
f. Mention the governmental agencies that regulates and control drug abuse

Previous Knowledge: Students have seen and taken drugs administered to them in the hospital.

Instructional materials: paracetamol cigarette text book and chart containing various drugs

Method of Teaching: Self- regulated learning strategy

Introduction: The teacher introduces her lesson by asking the student what kind of drugs they take when sick.

Presentation and development

Facts to be taught	Time Mins	Teachers activities	Students activities
Step 1 Introduction of concept drug	5	Teacher guides the students to define the term drugs. as a substance that changes the way the body works	Students attempt to define the term drug
Step 2 Display of chart with various sample of drugs	20	Teacher displays chart containing various drugs on the wall for the students to see and identify simple and harmful drugs.	Students take a look at various drugs and try to identify the harmful ones.
Step 3 Distinguish between drugs and drug abuse and their effects to mankind	20	Teacher instructs the students to do their work individually. There should be no talking or discussion, no canopying or looking at someone's work. A worksheet is distributed to them to write out all the answers to the questions raised.	Students are expected to get busy. To write out their ideas, facts thoughts, concepts as they monitor and self-evaluate themselves.
Step 5 Control/preventive measures	20	Teacher instructs the students to write out their answers in the worksheet given to them individually, no sharing of ideas or copying from some one else and no discussion or talking	Students are busy studying comprehending and responding to the questions raised.
Step 6 Activities on drug/ drug abuse	10	Teacher collects the activity worksheets marks and scores them at the end of the allow time.	Students submit their various answers on the worksheet to the teacher to mark and score them.

Evaluation: The teacher evaluates the students by asking them the following questions 5mins

a. Define the term drug
b. Distinguish between drug and drug abuse
c. Discuss the benefits of drugs to human being
d. Explain the harmful effect of drug abuse in mankind
e. State how drug abuse can be prevented
f. Mention the governmental agencies that regulates and control drug abuse

Conclusion / summary: The teacher concludes her lesson by reminding the students once more about the harmful effect of drug abuse.

Assignment: i. list five drugs you know that are harmful to human beings

ii. give the full meaning of NAFDAC AND NDLEA

LESSON PLAN: Self-regulated

CLASS -` UB2

SUBJECT – Basic science

TOPIC – Diseases

TIME- double period (80mins)

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

a. define the term diseases
b. discuss very type of diseases
c. describe the mode of transfer of diseases
d. List common examples of disease vectors
e. Explain ways by which disease can be prevented and controlled
f. What are the roles played sanitation and education in the control and prevention of disease

Previous / knowledge: Students had an experience of being sick or infected with the diseases

Instructional materials: Textbook showing infected persons and the life cycle of mosquito

Method of teaching: Self-regulated Learning Strategy

Introduction: The teacher introduce her lesson by asking the student whether, they have ever fall sick in one time or the other

Presentation and development

Facts to be taught	**Time** **Mins**	**Teachers activities**	**Students activities**
Step 1 Diseases	5	Teacher guides the students to define the term disease as a departure from normal state of health.	Students attempt to define the term diseases
Step 2 Types of diseases and mode of transmission	20	Teacher distributes worksheet to individual students, she asks them to answer the questions individually without sharing ideas with any one. She directs them to use their initiative to study the lesson note given to them, comprehend, and rehearse it to come out with expected answers using self-instructional methods while teacher serves as a guide.	Students are expected to get busy and write out their ideas, facts, and thoughts as they monitor and self-evaluate themselves.
Step 3 Displayed of chart showing infected persons and life cycle of mosquito	5	Asks students to identifies who is a sick person among people showing on the chart and a life cycle of mosquito showing how parasite cause malaria fever	Student identify how sick people behave
Step 4 Mention two Roles played sanitation and education in curbing disease	20	The teacher ask the student to write out the role sanitation and education play in curbing disease	Student are working hard to come out with expected answer

Step 5 Prevention and control	15	Teacher guides the student to write out preventive and control measures of diseases	Student list the preventive and control measure
Marking of scripts	10	Teacher collected their worksheets, marks and score them and make correction. She gives room for questioning for elucidation	Students ask questions and give response to questions.

Evaluation: Evaluates the students by asking them oral questions based on stated objectives to get the feedback concerning the lesson 5mins

a. define the term diseases
b. discuss very type of diseases
c. describe the mode of transfer of diseases
d. List common examples of disease vectors
e. Explain ways by which disease can be prevented and controlled
f. Mention two roles played by sanitation and education in the control and prevention of disease

Conclusion / summary: The teacher summarizes her lesson by reminding the students not to catch up with any diseases nor spread it, but to keep themselves and environment clean and free from germs.

Assignment: Read about immunization and prepare to answer questions in the next class

9) LESSON PLAN: Control group

CLASS – upper basic 2 (UB2)

SUBJECT – Basic science

TOPIC- Metabolism of food in human body

SUBTOPIC – Digestion of food

TIME- Double period (80 minutes)

BEHAVIOUR OBJECTIVES

By the end of the lesson, students should able to;

i. Briefly explain the term digestion.
ii. Mention five organs of digestive system and state the functions of each.
iii. Excess food stored in the body in the form of what?
iv. What are the problems associated with excess food stored in the body
v. Describe the process of absorption of food materials in the body.
vi. Match the following organs (mouth, stomach and small intestine) with their juices

Previous Knowledge: student had background knowledge about how food is processed in the body

Instruction material: chart showing human digestive system

Method of teaching: Demonstration

Introduction: The Teacher starts by asking the students questions of what they have eaten in the morning as breakfast and what are the process involved

Presentation and Development

Facts to be taught	**Time** **Mins**	**Teachers activities**	**Students activities**
Step 1 Introduction of concept digestion	5	The teacher writes the word digestion and ask the students to define it with the aid of the teachers as the process by ingested food material are broken down into smaller particles which can be absorbed in the body	Students try to define it
Step 2 Display of digestive system chart	10	The teacher displays the digestive system chart on the wall and demonstrate how food is taken from the mouth process and move out of the anus	Students sit and listen and watch keenly
Step 3 Digestive organs and their function	20	The teacher shows the students various organs and their functions on the chart as she writes them on the board for the students to copy	Students listen, watch and copy notes.

Step 4 Digestive juices and their location, absorption and storage of food in the body	20	Teacher writes down the digestive juice and where each juice if found pointing out the organs that are responsible for absorption an storage of food materials in the body as she demonstrate	Students listen, watch and copy notes
Step 5 Problems associated with food storage in the body	20	Teacher writes down the problems of food storage in the body for instance excess sugar and fat can lead to diabetes and malfunctioning of the heart respectively	Students listen and take down notes

Evaluation: The teacher evaluates the students by asking them few questions such as 5mins

i. Briefly explain the term digestion.

ii. Mention five organs of digestive system and state the functions of each.

iii. In what forms is excess food stored in the body.

iv. What are the problems associated with excess food stored in the body

v. Describe the process of absorption of food materials in the body.

vi. Match the following organs (mouth, stomach and small intestine)with their juices

Conclusion/ summary: The teacher concludes her lesson by summarizing the key points in the lesson objectives

Assignment: Draw and label digestive system and indicate with an arrow the flow of food and submit next lesson.

C. LESSON PLAN FORCONTROL GROUP 3 (CG_3) DEMOSTRATION METHOD

CLASS: Upper basic 2 (UB2)

SUBJECT: Basic Science

TOPIC: Elements, Compound and Mixture

DURATION: Double period(80 Mins)

BEHAVIOURAL /OBJECTIVES: by the end of the lesson, students should be able to

a. Define an element
b. Distinguish between a compound and a mixture
c. Explain why a compound is a chemical change and not a physical change
d. In a tabular form, state three properties of compound and a mixture
e. Write out the constituents of a mixture
f. Identify compound and their component elements

Previous Knowledge: students had background knowledge about element compound and mixture in their UB2 class previously

Instructional materials: Salt, mixture of irony filling and sand

Method of teaching: Demonstration

Introduction: The teachers asks the students to mention the name of salt used in our food

Presentation and Development

Facts to be taught	**Time** **Mins**	**Teachers activities**	**Students activities**
Step 1 Introduction of concepts compound and mixture	10	Ask the students to define the concepts element, compound and mixture	Students attempt to define the concepts with the aid of the teacher
Step 2 Differentiate between compound and mixture	20	Teacher displays common salt and mixture of pins and sand on the demonstration table and share them into groups and ask them to come group by group for demonstration on table and watch the teacher carry put the experiment, on separation techniques	Students listen and observe carefully the changes that occurs in the two samples as pins can be separated easily by physical means and salt can be separated by physical change which undergoes heating to dryness.
Step 3 Components and constituents of compound and mixture	20	The teacher lists the compound and constituents of mixture on the chalk board for the students to copy	Students write the key points into their note books as they listen attentively to the lesson
Step 4 Elicitation of ideas	30	The teacher gives room for questioning at the end of the lesson for further clarification of the facts	Students ask questions and respond to answer with the teacher explaining the facts or key points

Evaluation: The teacher asks the students to explain the concept of element, compound and mixture**.**

a. Define an element
b. Distinguish between a compound and a mixture
c. Explain why a compound is a chemical change and not a physical change
d. In a tabular form, state three properties of compound and a mixture
e. Write out the constituents of a mixture
f. Identify compound and their component elements

Conclusion/ summary: The teacher concludes the lesson by going over and over the salient points.

Assignment: Read about method of separation of mixture and prepare to answer question in the next class.

11)

LESSON PLAN: control group

CLASS – upper basic 2 (UB2)

SUBJECT- Basic science

TOPIC – Drug abuse

TIME – double period (80 mins)

BEHAVIOURAL OBJECTIVES

By the end of the lesson, students should be able to

a. Define the term drug
b. Distinguish between drug and drug abuse
c. Discuss the benefits of drugs to human being
d. Explain the harmful effect of drug abuse in mankind
e. State how drug abuse can be prevented
f. Mention the governmental agencies that regulates and control drug abuse

Previous Knowledge: Students have seen and taken drugs administered to them in the hospital.

Instructional materials: Paracetamol cigarette, textbook chart containing various drugs

Method of teaching: Demonstration

Introduction: The teacher introduces her lesson by asking the student what kind of drugs they take when sick.

Presentation

Facts to be taught	Time Mins	Teachers activities	Students activities
Step 1 Introduction of concept drug	5	Teacher guides the students to define the term drugs as a substance that changes the way the body works	Students attempt to define the term drug
Step 2 Display of chart with various sample of drugs	20	Teacher displays the chart on the wall for the students to see. She demonstrate how drug abuse leads many youth to be mad or insane, cause damage the lungs, liver and so on. Showing examples in the textbooks.	Students listen watch and observe keenly as the demonstrates how mad people exhibit their behavior
Step 3 Distinguish between drug and drug abuse and their effects	25	Teacher explains the different between drugs and drug abuse as when drugs are taken as prescribed by the physician and when you over take it become drug abuse, and some other hard drugs e.g. Indian herm, caffeine etc can lead to madness. Teacher call out one student to come and demonstrate how mad people behaved. She also states the benefits of drugs as it heals our sicknesses and diseases and how hard drugs can cause insanity to man kind	Students listen, watch and take down notes
Step 4 Control measures	15	Teacher mentions ways of controlling drug abuse and agencies responsible for implementation of health policies by writing it on the chalkboard for the students to copy.	Students listen passively and take down key points

Step 5 Elicitation of ideas	10	Teacher gives room for questioning at the end of the lesson for further clarification of facts.	Students ask questions as well as give response to questions.

Evaluation : The teacher ask the students oral questions such as 5mins

a. Define the term drug
b. Distinguish between drug and drug abuse
c. Discuss the benefits of drugs to human being
d. Explain the harmful effect of drug abuse in mankind
e. State how drug abuse can be prevented
f. Mention the governmental agencies that regulates and control drug abuse

Conclusion / summary: The teacher concludes her lesson by reminding the students once more about the harmful effect of drug abuse**.**

Assignment: i**.** List five drugs you know that are harmful to human beings

ii. Give the full meaning of NAFDAC AND NDLEA

12)

LESSON PLAN: Control group(Demonstration method)

CLASS - UB2

+SUBJECT – Basic science

TOPIC – Diseases

TIME- Double period (80mins)

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

a. define the term diseases
b. discuss very type of diseases
c. describe the mode of transfer of diseases
d. List common examples of disease vectors
e. Explain ways by which disease can be prevented and controlled
f. Mention two roles played sanitation and education in the control and prevention of disease

Previous / knowledge: Students had an experience of being sick or infected with the diseases

Instructional materials: Textbook showing infected persons and a life cycle of mosquito

Method of teaching: Demonstration

Introduction: The teacher introduce her lesson by asking the student whether, they have ever fall sick in one time or the other.

Presentation and Development

Facts to be taught	Time Mins	Teachers activities	Students activities
Step 1 Disease	5	The teacher asks the students to define the term disease	Student made several attempt to define diseases
Step 2 Types of disease and mode of transmission	20	Teacher classify diseases into communicable and non communicable diseases and also state the modes of transmission of disease from one person to another on the chalkboard for the student to copy	Students listen and take down note
Step 3 Display of charts showing infected persons and life cycle of mosquito	20	A life cycle of mosquitoes is display for the students to see and identify the states of life cycle of mosquitoes that cause malaria fever.	Students listen, watch and take down notes
Step4 Roles played by sanitation and education	10	Teacher writes out the roles play by sanitation and education	Student and listen and observe keenly as they take down note
Step 5 Preventive and control	15	Teacher demonstrates how a person suffering from diseases look like. She further state ways of preventing and controlling disease vectors on the chalk board for the students to copy	Students listen and copy notes

Evaluation: Evaluates the students by asking them oral questions based on stated objectives to get the feedback concerning the lesson 5mins

a. define the term diseases
b. discuss very type of diseases
c. describe the mode of transfer of diseases
d. List common examples of disease vectors
e. Explain ways by which disease can be prevented and controlled
f. Mention two roles played sanitation and education in the control and prevention of disease

Conclusion / summary: The teacher summarizes her lesson by reminding the students not to catch up with any diseases nor spread it, but to keep themselves and environment clean and free from germs.

Assignment: Read about immunization and prepare to answer questions in the next lesson

APPENDIX F

PILOT RAW DATA FOR THE EXPERIMENTAL AND CONTROL GROUPS

S/N	Identity	Sex	Pre-Test BSAT Scores	Post-Test BSAT scores	Age
1	PCL	M	24	28	13
2	PCL	M	32	35	14
3	PCL	F	29	26	13
4	PCL	F	22	24	15
5	PCL	M	28	30	14
6	PCL	F	30	32	13
7	PCL	F	28	29	13
8	PCL	F	26	28	14
9	PCL	M	29	32	13
10	PCL	M	28	31	14
11	SRL	F	28	30	13
12	SRL	F	32	35	12
13	SRL	M	32	36	14
14	SRL	M	25	30	13
14	SRL	M	24	28	15
16	SRL	F	20	26	14
17	SRL	M	27	29	13
18	SRL	F	30	34	14
19	SRL	M	29	33	15
20	SRL	M	30	35	13

CONTROL GROUP

S/N	Identity	Sex	Pre-Test BSAT Scores	Post-Test scores	Age
21	CLT	M	22	31	13
22	CLT	F	25	30	14
23	CLT	M	21	28	13
24	CLT	M	28	30	14
25	CLT	M	33	35	15
26	CLT	F	19	24	13
27	CLT	F	26	29	14
28	CLT	M	29	33	13
29	CLT	F	22	29	13
30	CLT	F	23	25	14

APPENDIX G

RELIABILITY ANALYSIS OF BASIC SCIENCE ACHIEVEMENT TEST (BSAT) USING KUDAR RICHARDSON 20 (KR_{20})

Descriptive Statistics

	N	Mean	Std. Deviation	Variance
VAR00001	40	23.5000	5.45847	29.795
Valid N (listwise)	40			

n= number of items= 40

$KR_{21} = n/n\text{-}1(1-\sum pq/s^2)$

$= 40/39(1-(29.795/[29.795]^2)$

$= 40/39(0.9664373)$

$=$ **0.99**

APPENDIX H

ITEM ANALYSIS FOR TELS

S/No	Discrimination Index	Distractor Index	Difficulty Index	Remark
1	0.42	-0.33	0.74	Selected
2	0.33	-0.33	0.61	Selected
3	0.67	-0.67	0.83	Selected
4	0.33	-0.33	0.73	,,
5	0.67	-0.67	0.70	,,
6	0.87	-0.87	0.63	,,
7	0.87	-0.87	0.83	,,
8	0.67	-0.67	0.57	,,
9	0.20	-0.20	0.57	,,
10	0.33	-0.33	0.87	Selected
11	0.33	-0.33	0.73	,,
12	0.67	-0.67	0.73	,,
13	0.33	-0.33	0.40	,,
14	0.67	-0.67	0.53	Selected
15	0.28	-0.30	0.98	*Rejected
16	0.87	-0.87	0.70	Selected
17	0.67	-0.67	0.83	,,
18	0.33	-0.33	0.40	,,
19	0.33	-0.33	0.50	,,
20	0.67	-0.67	0.70	,,
21	0.33	-0.33	0.57	,,
22	0.67	-0.67	0.53	,,
23	0.87	-0.87	0.63	,,
24	0.87	-0.87	0.63	,,
25	0.67	-0.67	0.57	,,
26	0.33	-0.33	0.40	,,
27	0.33	-0.33	0.70	,,
28	0.67	-0.67	0.73	,,
29	0.33	-0.33	0.63	,,
30	0.67	-0.67	0.40	,,
31	0.20	-0.20	0.54	,,
32	0.87	-0.87	0.63	Selected
33	0.25	-0.23	0.95	*Rejected
34	0.33	-0.33	0.53	Selected
35	0.33	-0.33	0.53	,,
36	0.67	-0.67	0.70	,,
37	0.33	-0.33	0.73	,,
38	0.67	-0.67	0.37	,,
39	0.87	-0.87	0.57	,,
40	0.29	-0.11	0.99	*Rejected
41	0.67	-0.67	0.73	Selected
42	0.28	-0.33	0.24	*Rejected
43	0.33	-0.33	0.63	Selected
44	0.67	-0.67	0.67	,,
45	0.23	-0.33	0.19	*Rejected

APPENDIX I

SCHOOLS AND THEIR SAMPLED POPULATION

SCHOOL STUDENTS	TOTAL POPULATION OF			EXPERIMENTAL GROUP		
	M	F	TOTAL	M	F	TOTAL
Experimental group 1						
Peer collaboration						
Govt, Model Sch. Mkd	104	110	214	21	22	43
Anglican Sec Sch. Mkd	60	65	125	12	13	25
Experimental group 2						
Self-regulated learning						
Govt Sec Sch NAF Mkd	20	23	43	4	4	8
Methodist High Sch. Mkd	44	54	98	9	11	20
Control group						
Demonstration method						
Padopas Sec Sch Mkd	41	71	112	8	14	22
Comm Sec Sch. Mkd	20	28	48	4	6	10
Total	**284**	**349**	**638**	**58**	**70**	**128**

Key: M = male, F = female

APPENDIX J

Procedure For Experimental And Control Learning Condition

Condition	Before treatment	Treatment			After treatment
PCL	Pretest	presenting text-materials	instructions	learning task	post-test
SRL	Pretest	presenting text-materials	instructions	learning task	post-test
CTL	Pretest	presenting text-materials	instructions	learning task	post-test
Time (mins)	max.40mins	5mins	5mins	30mins	max.40 mins

APPENDIX K

SCHEDULE FOR TRAINING OF RESEARCH ASSISTANTS (RA)

Day	**Instructional Strategy**	**Group**	**Duration of training**	**Duration of presentation after training of RA**
Wednesday	**PCL,** the researcher exposed the R.A to Peer collaboration guidelines , lesson plans and lessons notes of this new approach	1	80 minutes	40 minutes
Thursday	**SRLS,**the researcher exposed the R.A to self-regulated learning guidelines , lesson plans and lessons notes of this new approach	2	80 minutes	40 minutes
Friday	**DM,** normal teaching of Demonstration method by R.A	3	40 minutes	30 minutes

APPENDIX L

TRAINING MANUAL FOR RESEARCH ASSISTANTS

DAY	GROUP	EVENT
Tue	Experimental Group1 PCL	researcher explains thus i. aim and objective of the training program ii. Topics in BSAT which is the instruction package ii,. Duration, time, scoring and administration of BSAT instrument by teachers iv, The procedure involved in teaching using PCLs lesson plan v, The prepared lesson plan was presented to the research assistant(RA) vi, R.A taught as micro teaching for 15 minutes vii, Questions, clarification and suggestions for improvement where made
Wed	Experimental Group 2 SRLS	i. aim and objective of the training program ii. Topics in BSAT which is the instruction package ii. Duration, time, scoring and administration of BSAT instrument by teachers iv, The procedure involved in teaching using SRLS lesson plan v, The prepared lesson plan was presented to the research assistant(RA) vi, R.A taught as micro teaching for 15 minutes

		vii, Questions, clarification and suggestions for improvement where made
Thurs	Control Group 3(DM)	i. aim and objective of the training program ii. Topics in BSAT which is the instruction package iii. Duration, time, scoring and administration of BSAT instrument by teachers iv. Explain to teachers use of demonstration method v, The prepared lesson plan was presented to the research assistant(RA) vi, R.A taught as micro teaching for 15 minutes vii, Questions, clarification and suggestions for improvement where made

APPENDIX M

RAW DATA FOR THE MAIN STUDY

S/N	GENDER	GROUP	PRE-TEST(x)	POST-TEST(y)
1.	1	1	23	28
2.	1	1	15	22
3.	2	1	24	22
4.	1	1	33	35
5.	2	1	29	26
6.	2	1	22	24
7.	2	1	30	32
8.	1	1	28	30
9.	1	1	28	29
10.	1	1	26	28
11.	2	1	29	32
12.	2	1	28	31
13.	2	1	25	30
14.	1	1	19	21
15.	2	1	24	26
16.	1	1	21	25
17.	1	1	16	20
18.	1	1	18	19
19.	2	1	20	23
20.	2	1	27	29
21.	1	1	27	35
22.	2	1	10	23
23.	1	1	12	18
24.	2	1	17	22
25.	2	1	26	30
26.	2	1	18	22
27.	1	1	27	28
28.	1	1	25	27
29.	1	1	21	26
30.	2	1	27	31
31.	1	1	20	23
32.	2	1	19	29

33.	1	1	28	30
34.	1	1	28	32
35.	2	1	16	18
36.	2	1	26	24
37.	2	1	22	25
38.	1	1	31	33
39.	2	1	24	25
40.	2	1	18	20
41.	1	1	29	31
42.	1	1	30	32
43.	1	1	28	15
44.	1	1	14	17
45.	1	1	12	28
46.	2	2	12	18
47.	2	2	19	21
48.	2	2	21	25
49.	1	2	20	24
50.	1	2	23	26
51.	2	2	25	27
52.	1	2	18	20
53.	2	2	15	19
54.	1	2	13	18
55.	2	2	12	16
56.	1	2	28	30
57.	2	2	27	29
58.	1	2	26	26
59.	1	2	23	24
60.	2	2	25	33
61.	1	2	21	32
62.	1	2	24	26
63.	1	2	19	23
64.	1	2	18	21
65.	2	2	27	30
66.	1	2	22	25
67.	1	2	21	24

68.	1	2	17	19
69.	1	2	16	18
70.	2	2	12	15
71.	2	2	14	17
72.	1	2	11	14
73.	1	2	16	18
74.	1	2	14	16
75.	1	2	15	20
76.	2	2	19	21
77.	1	2	18	20
78.	1	2	13	15
79.	1	2	17	21
80.	1	2	20	24
81.	1	2	23	25
82.	2	2	21	23
83.	1	2	20	21
84.	1	2	17	19
85.	1	2	15	18
86.	2	2	15	11
87.	1	3	5	10
88.	2	3	8	18
89.	2	3	14	19
90.	1	3	16	16
91.	2	3	13	9
92.	2	3	4	10
93.	1	3	6	10
94.	1	3	7	20
95.	2	3	15	22
96.	1	3	17	20
97.	2	3	18	21
98.	1	3	16	15
99.	2	3	8	14
100.	1	3	9	16
101.	2	3	11	22

102.	2	3	17	15
103.	2	3	12	23
104.	1	3	19	25
105.	1	3	20	12
106.	2	3	7	15
107.	1	3	9	18
108.	2	3	12	14
109.	1	3	9	14
110.	1	3	10	13
111.	1	3	11	19
112.	2	3	18	25
113.	1	3	22	8
114.	2	3	4	9
115.	1	3	7	14
116.	1	3	11	18
117.	2	3	13	20
118.	1	3	15	19
119.	1	3	16	18
120.	1	3	9	17
121.	2	3	8	15
122.	1	3	6	13
123.	2	3	5	14
124.	1	3	9	16
125.	1	3	12	23
126.	1	3	21	25
127.	1	3	18	21
128.	1	3	15	19

GROUP 1 – PCL- 46

GROUP 2- SRL-41

GROUP 3 – DEMOSTRATION (DM}-41

TOTAL=128

GENDER 1- MALE-67

GENDER 2- FEMALE -61

TOTAL=128

APEPENDIX N

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DATA ANALYSIS

[DataSet0] C:\Users\HP\Documents\JIRGBA CHRISTY.sav

Frequency Table

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	67	52.3	52.3	52.3
	Female	61	47.7	47.7	100.0
	Total	128	100.0	100.0	

Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Peer Collaboration Learning Strategy (PCLS)	46	35.9	35.9	35.9
	Self Regulated Learning Strategy (SRLS)	41	32.0	32.0	68.0
	Demonstration Method (DM)	41	32.0	32.0	100.0
	Total	128	100.0	100.0	

RQ 1

Group		PreBSAT	PostBSAT
Peer Collaboration Learning Strategy (PCLS)	Mean	21.3913	26.4565
	N	46	46
	Std. Deviation	4.62591	5.11080
Demonstration Method (DM)	Mean	12.3659	16.8780
	N	41	41
	Std. Deviation	3.93545	4.65937
Total	Mean	17.1379	21.9425
	N	87	87
	Std. Deviation	6.23973	6.84777

RQ 2

Group		PreBSAT	PostBSAT
Self Regulated Learning Strategy (SRLS)	Mean	18.5366	21.7561
	N	41	41
	Std. Deviation	4.41643	5.04371
Demonstration method (DM)	Mean	12.3659	16.8780
	N	41	41
	Std. Deviation	3.93545	4.65937
Total	Mean	15.4512	19.3171
	N	82	82
	Std. Deviation	5.18819	5.41347

RQ 3

Group		PreBSAT	PostBSAT
Peer Collaboration Learning Strategy (PCLS)	Mean	21.3913	26.4565
	N	46	46
	Std. Deviation	4.62591	5.11080
Self Regulated Learning Strategy (SRLS)	Mean	18.5366	21.7561
	N	41	41
	Std. Deviation	4.41643	5.04371
Total	Mean	20.0460	24.2414
	N	87	87
	Std. Deviation	4.72477	5.57395

RQ 4

Gender		PreBSATPCLS	PostBSATPCLS
Male	Mean	21.2857	26.5238
	N	21	21
	Std. Deviation	5.34923	5.48287
Female	Mean	21.4800	26.4000
	N	25	25
	Std. Deviation	4.03237	4.89047
Total	Mean	21.3913	26.4565
	N	46	46
	Std. Deviation	4.62591	5.11080

RQ 5

Gender		PreBSATSRLS	PostBSATSRLS
Male	Mean	18.3704	21.7407
	N	27	27
	Std. Deviation	3.75344	4.34646
Female	Mean	18.8571	21.7857
	N	14	14
	Std. Deviation	5.62764	6.36310
Total	Mean	18.5366	21.7561
	N	41	41
	Std. Deviation	4.41643	5.04371

Univariate Analysis of Variance

Ho 1: Tests of Between-Subjects Effects

Dependent Variable:PostBSAT

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2701.683[a]	4	675.421	41.610	.000
Intercept	568.246	1	568.246	35.008	.000
PreBSAT	695.204	1	695.204	42.829	.000
Group	130.074	1	130.074	8.013	.006
Gender	5.051	1	5.051	.311	.578
Group * Gender	1.152	1	1.152	.071	.791
Error	1331.029	82	16.232		
Total	45921.000	87			
Corrected Total	4032.713	86			

a. R Squared = .670 (Adjusted R Squared = .654)

Ho 2: Tests of Between-Subjects Effects

Dependent Variable:PostBSAT

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1651.740[a]	4	412.935	44.038	.000
Intercept	148.751	1	148.751	15.864	.000
PreBSAT	1146.522	1	1146.522	122.272	.000
Group	8.229	1	8.229	.878	.352
Gender	3.895	1	3.895	.415	.521
Group * Gender	.051	1	.051	.005	.942
Error	722.016	77	9.377		
Total	32972.000	82			
Corrected Total	2373.756	81			

a. R Squared = .696 (Adjusted R Squared = .680)

Ho 3: Tests of Between-Subjects Effects

Dependent Variable:PostBSAT

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1403.225[a]	4	350.806	22.674	.000
Intercept	376.115	1	376.115	24.309	.000
PreBSAT	924.074	1	924.074	59.725	.000
Group	134.536	1	134.536	8.695	.004
Gender	1.684	1	1.684	.109	.742
Group * Gender	.010	1	.010	.001	.980
Error	1268.706	82	15.472		
Total	53797.000	87			
Corrected Total	2671.931	86			

a. R Squared = .525 (Adjusted R Squared = .502)

Ho 4: Tests of Between-Subjects Effects

Dependent Variable:PostBSATPCLS

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	287.685[a]	2	143.843	6.967	.002
Intercept	439.317	1	439.317	21.280	.000
PreBSATPCLS	287.510	1	287.510	13.927	.001
Gender	.603	1	.603	.029	.865
Error	887.728	43	20.645		
Total	33373.000	46			
Corrected Total	1175.413	45			

a. R Squared = .245 (Adjusted R Squared = .210)

Ho 5: Tests of Between-Subjects Effects

Dependent Variable:PostBSATSRLS

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	707.988[a]	2	353.994	43.453	.000
Intercept	33.986	1	33.986	4.172	.048
PreBSATSRLS	707.969	1	707.969	86.903	.000
Gender	1.617	1	1.617	.198	.658
Error	309.573	38	8.147		
Total	20424.000	41			
Corrected Total	1017.561	40			

a. R Squared = .696 (Adjusted R Squared = .680)

Ho 6: Tests of Between-Subjects Effects

Dependent Variable:PostBSAT

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3367.052[a]	6	561.175	40.317	.000
Intercept	516.524	1	516.524	37.109	.000
PreBSAT	1359.586	1	1359.586	97.679	.000
Group	148.397	2	74.198	5.331	.006
Gender	5.126	1	5.126	.368	.545
Group * Gender	.782	2	.391	.028	.972
Error	1684.190	121	13.919		
Total	66345.000	128			
Corrected Total	5051.242	127			

a. R Squared = .667 (Adjusted R Squared = .650)