EFFECTS OF THREE MODES OF COOPERATIVE LEARNING STRATEGY ON CHEMISTRY STUDENTS'PERFORMANCE AND MOTIVATION IN KADUNA METROPOLIS, NIGERIA

BY

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A DESERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIESIN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER DEGREE IN INSTRUCTIONAL TECHNOLOGY

DEPARTMENT OF EDUCATIONAL FOUNDATIONS AND CURRICULUM,
FACULTY OF EDUCATION,
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ZARIA, NIGERIA

JUNE, 2021

DECLARATION

I hereby declare that this research on"Effects of Three Modes of Cooperative Learning Strategy on Chemistry Students' Performance and Motivation in Kaduna Metropolis, Nigeria", was carried out by me in the Department of Educational Foundation and Curriculum, Faculty of Education, Ahmadu Bello University, Zaria. All citations have been duly acknowledged and no part of this work was previously presented for another degree at this or any other university.

_____ _____

Maina Bukar David **Date**

P14EDFC8086

CERTIFICATION

This research work titled "Effects of Three Modes of Cooperative Learning Strategy on Chemistry Students' Performance and Motivation in Kaduna Metropolis, Nigeria " meets the regulation governing the award of Master's Degree in Instructional Technology of the Department of Educational Foundation and Curriculum, Faculty of Education, Ahmadu Bello University, Zaria is approved for its contribution to knowledge and literary presentation**.**

_____ _____

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Prof. S. Abdullahi Date

Dean, School of Post-Graduate Studies

DEDICATION

This work is dedicated to my mother, for encouraging me to work hard and never give up, no matter how tough the journey is.

ACKNOWLEGEMENTS

To God be the glory for it is not by my power nor my might but by His grace that is superfluous and more than sufficient. I thank Him for making this programme a reality. During the undertaking of this work, i received invaluable assistance and encouragement from various people whom i wish to acknowledge here. First among them is my supervisors Dr. A.D Aliyu and Dr. S.A Zubairu for their insightful, firm and strict but friendly guidance and assistance. It is through their effort and tolerance that i was able to accomplish this work. My lecturers from the Department of Educational Foundations and Curriculum have all contributed immensely to the success of this level of my academic pursuit, and i am saying thank you very much. I acknowledges all principals, teachers and students in all the three public secondary schools used for the research work in Kaduna metropolis, for their cooperation. To my dad; Bukar Maina Bwala and my mum; Naomi Bukar Maina; may God Almighty reward them immensely for their unquantifiable level of prayers, support and encouragement without which i would not have become who i am today. To my brother; Bitrus Bukar Maina, i earnestly recognized your prayer, moral and material support. I extends my appreciation to my lovely sisters; Asabe Bukar Maina; Comfort Bukar Maina and Kubily Bukar Maina for their prayers and relentless support which tremendously strengthen me in the course of this research work. I am very grateful to my beloved friend Nhaltu Elisha who have overwhelmed me with consistent support and filling the gap for my family, more especially during difficulty moments of writing this research work.

May you all receive God's blessings in abundance?

ABSTRACT

This study examined the effects of three modes of cooperative learning strategy on chemistry students' performance and motivation in Kaduna Metropolis, Nigeria.The study was guided by four research questions and four null hypotheses which were tested at 0.05 alpha levels. Comparative effects of video, Facebook and WhatsApp-based cooperative learning instructional strategy were explored. The instrument and the treatment packages used in the study were researcher adapted Chemistry Performance Test, Chemistry Motivation Scale, Video Based Cooperative Learning Instructional Package, Facebook Based Cooperative Learning Instructional Package and WhatsApp Based Cooperative Learning Instructional Package, which were validated by experts. The study employed quasi-experimental post-test control group research design. The sample population comprises of 120 SS2 Chemistry students drawn from three government secondary schools in Kaduna Metropolis. Three classes were selected through simple random sampling technique from the selected schools. Mean and standard deviation were used to answer the two research questions while ANOVA was used to test the two null hypotheses. Findings of the study revealed that students taught with Facebook Based Cooperative learning Instructional Package and WhatsApp Based Cooperative Learning Instructional Package have almost the same low level of performance, while students taught with video Based Cooperative Learning Instructional Package perform much better and therefore have increased academic performance. The findings of the research work also indicated that students taught using Facebook and WhatsApp Based Cooperative Learning Instructional Packages were more motivated than their counterparts taught using Video Based Cooperative Learning Instructional Package. Finally, it was recommended that Video, Based Cooperative Learning Instructional package should be used to teach so as to enhance students' academic performance; Teachers should incorporate video, Facebook and WhatsApp Based Cooperative Learning Instructional packages as part of their instructional delivery strategy in order to motivate and enhance students learning; Irrespective of gender video, Facebook and WhatsApp Based Cooperative Learning Instructional packages should be used to teach in order to enhance students' academic performance; Video, Facebook and WhatsApp Based Cooperative Learning Instructional packages should be used to teach students irrespective of gender so as to increase their academic motivation.

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LIST OF ABBREVIATIONS

ADDIE: Analysis, Design, Development, Implementation, and Evaluation

ADHD: Attention Deficit Hyperactivity Disorder

CPT: Chemistry performance Test

CESAC: Comparative Education Study and Adaptation Centre

CMS: Chemistry Motivation Scale

CTML: Cognitive Theory of Multimedia Learning

EFL: English as a Foreign Language

FBCLIP: Facebook based cooperative learning instructional package

ICT: information and communication technologies

JAMB: admission and matriculation board

LEAP: Leveraging Educational Assistance Partnership

ANOVA: Analysis of Variance

MIU: mobile Internet unit

NEA: National Education Association

NECO: national examination council

NEPAD: New Partnership for Africa's Development

NITDA: National Information Technology Development Agency

NTI: National Teachers' Institute

OTT : over-the-top tell;

PDAs: personal digital assistants

RR: Reading Rockets

SPSS: Statistical Package for Social Sciences

SS1: senior secondary year one

SS2: senior secondary year two

SSSCE: senior secondary school certificate

U.K: United Kingdom

UNESCO: United nation educational scientific and cultural organization

VBCLIP: video based Cooperative Learning instructional package

VSAT: Very small aperture terminal

WAEC: West African Examination Council

WBCLIP: WhatsApp based Cooperative learning Instructional Package

Operational Definition of Terms

Cooperative Learning: - This is an instructional strategy composed of 2 to 4 students per group who were taught air pollution Chemistry contents with the aid of video, Facebook and WhatsApp.

Academic Performance: - It is the result of Chemistry Performance Test (CAPT) scores of students, after being taught air pollution content of Chemistry using video, Facebook and WhatsApp based cooperative learning instructional package.

Technology Integration:-This refers to the use of cooperative learning embedded with video, Facebook and WhatsApp to teach air pollution chemistry content to SSII students.

Motivation:- This is the degree of interest developed by students after they were taught air pollution, using cooperative learning embedded with video, Facebook and WhatsApp based cooperative learning instructional package.

Video: -This refers to motion image and sound that is used with cooperative learning instructional strategy to teach air pollution chemistry content to SSII students

Facebook:-This refers to one of the social network used with cooperative learning instructional strategy to teach air pollution chemistry content to SSII students.

WhatsApp:-This refers to another social network used with cooperative learning to teach air pollution chemistry contents to SSII students.

ICT: -It stands for information and communication technologies which include; video, Facebook and WhatsApp that were used with cooperative learning instructional strategy to teach SSII students air pollution content of chemistry.

Chemistry: - This refers to science subject that deals with the study of matter in which students were taught using cooperative learning instructional strategy integrated with video, Facebook and WhatsApp.

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

Provision of quality education is fundamental for the scientific and technological progress of every nation. That is why one of the main goals of the Nigerian government in education is to provide the best possible opportunities for all citizens to learn and become good citizens capable of developing their talents and natural endowments / traits in the interest of the nation's economic and technological development (FGN, 2013). The aim of education is to help individuals increase their potential to the best possible level for self-reliance and national development. Todaro and Smith (2011) stated that investing in education leads to faster growth for developed and newly industrialized countries. This is the main reason why developing countries, particularly in sub-Saharan Africa, are now interested in investing in primary, secondary and tertiary education by increasing enrollment and improving the quality of education, more particularly in scientific subjects. Chemistry is one of the most important science subjects offered in secondary school in Nigeria. Chemistry is an important subject for the construction of scientific and technological knowledge and skills in learners (Emmanuel, 2013; Hornby, 2010). It is a subject that studies the structure, interactions, transformations and energy consequences of matter (Ikechukwu, 2011). It is one of the core science subjects that is required for students to succeed at the credit level in order to qualify for admission into higher institutions to study science-based causes (Yusuf, 2014). Chemistry is considered the central science subject because its interests lie between those of physics and biology. Emendu (2014) found that chemistry contributed to the development of modern technology by applying its principles to modern inventions.

The study of chemistry will continue to be of utmost importance to mankind because chemistry is able to explain natural phenomena and everyday events. Fanzo; Remans and Sanchez, (2011) observed that chemistry made food more plentiful by improving agricultural production, provided improved clothing through chemically treated synthetic and natural fibers making them resistant to stains, winkles and water. Chemistry has given us shelter and important materials for construction and repair. Chemistry also provided us with medicines for health care and fuel for transportation (Majekodunmi, 2007).

Many parts of chemistry concepts, like the equilibrium equation and periodicity, present headaches for teachers and students also struggle to understand (WAEC, 2011). Chemistry requires students to remember many facts and then relate the old and new concepts. Students often rely on surface strategies to memorize facts without focusing on understanding or connecting content (Momsen; Offerdahl; Kryjevskaia; Montplaisir; Anderson & Grosz, 2013). This poses a problem for science education, because if meaningful learning does not occur, students may not really understand the material and ultimately make the connections necessary to solve the problems. Lack of meaningful learning may be due to the way the material is presented or lack of knowledge of the skills needed to achieve meaningful levels of learning (Gambari, 2010).

Technology is seen as one of the means by which effective educational delivery can be achieved (Webcrawler, 2013). The combination of technology and an instructional strategy is crucial in finding better ways to facilitate students' understanding of chemistry (Williams, 2011). Technology is a tool that can help teachers embody best practices to create an enriched and supportive learning environment, meet a variety of

learning style needs, support learning transfer, help achieve long-term memory and deep understanding, approach high-level thinking, educate equitably, and incorporate real-world issues and authentic assessments. Technology has unique capabilities to design and deliver instruction in such a way that the learner is exposed to a real world experience (Kurt, 2010). Boyle (2006) argues that technology can be used to support the following approaches and that all learners can benefit: (i) active learning: learning by doing (ii) group learning: discussion, collaboration, (iii) metacognition: self-study and reflection on learning.

Technology integration is about using computers effectively and efficiently in general content areas to enable students to learn to apply computer skills in ways that enable them to solve academic tasks (Hubbard, 2013). Technology integration is the use of technology to drive the teaching and learning process. The integration of technology is not just about technology, it is above all about delivering effective learning content using computer technology. Technology involves the tools with which we deliver content and implement practices more effectively (Fullan, 2007). Successful technological integration should aim to improve the quality of education for all learners. It should be seen as a continuous innovative process designed to meet teaching / learning needs (Hew & Brush, 2007). Scheffler and Logan (1999) asserted that the integration of technology does not only involve the acquisition of computer skills, but is also a process in which learners try, fail, access, evaluate, analyze and apply tasks including but not limited to, research and data analysis.

Instructional video has proven to be an information and communication technology (ICT) tool that is very effective in providing a high quality teaching and

learning process in educational institutions (Greenberg et al. Zanetis, 2012). Educational video is a video that presents educational material on a topic to be learned (Giannakos, 2013). The use of video instructions with sophisticated graphics and illustrations can be created to present chemistry topics in a way that is essential to be done with a traditional textbook and a conventional or masterful teaching method (Adebayo, 2008). Video teaching offers great benefits to science and technology education (Gambari and Zabairu, 2006; Gbodi and Laleye, 2006). The instructional video not only presents the visual and oral discourse, it also shows this fact, illustrates it and puts it in a few moments in a vast context of knowledge related to the fact. It has been found that the duplication of sensory channels and the richness of the information elaborated are characteristics that contribute to the ease of learning and also to the retention strength of verbal information. Instructional video is used to achieve goals that are supposed to be reflected in the attitude of learners (Yousef; Chatti & Schroeder, 2014).

Okworo (2008) found that instructional videos influence, challenge, and enrich the classroom with material that is unlikely to be available in an actual classroom. Instructional video makes learning more lifelong because it improves learners' understanding by seeing and hearing simultaneously. It also allows for repetitive visualization, allowing learners to repeat the visualization, until the concept being taught is fully understood (Zhang, Lundberg & Eberhardt, 2010).

Facebook is a popular website that allows users to interact and collaborate within an existing virtual community (Boyd & Ellison, 2007). It is a social networking site and online communication tool that allows users to create a public or private profile in order to connect and interact with people within their extended social network (Godwin-Jones,

2008). Facebook is the world's largest social networking site, with nearly a billion members, which enables people to make connections, share interests, and join groups (Lantz-Andersson, Vigmo & Bowen, 2013). Facebook helps teachers create meaningful and dynamic educational experiences because it enables students to engage in meaningful and authentic interactions (Shih, 2011). Facebook can help learners to improve their language skills, increase their motivation and confidence in learning, and develop intercultural understanding. Platforms such as Facebook are useful for improving communication, human interaction, and learning. Facebook can be used as a practical tool to involve students in reading, writing and many other learning activities in a more incidental and informal way. Research has indicated that even students prefer to use Facebook to share certain educational activities such as multimedia or text-based learning resources and to interact with other classmates in discussions and debates (Joinson, 2008). Obviously, one of the main advantages of Facebook is that it allows people to share information, knowledge and resources (Kharbach, 2014).

WhatsApp instant messaging is a cross-platform smartphone messaging system that uses users' existing internet data plan to help them socialize in real time (Kuppuswamy & Narayan, 2010). WhatsApp offers online users the ability to send and receive different type of media, such as pictures, videos and audio multimedia messages in a very fast way. WhatsApp is one of the ingenious teaching platform that fascinates the attention and responsiveness of students and provides fun learning. It allows students to express their thoughts and ideas through various features like photo attachment, video sharing, web link sharing, video recording and many more (Dunlap, 2006). WhatsApp helps students enthusiastically engage in learning activities through various features

available on the app. WhatsApp can allow teachers to cover a large number of learners in a short period of time. Students in the same class can easily dialogue on certain topics via the application as this offers the possibility of an immediate response within the group members to join the chat, thus making the communication effective (Trentin & Repetto, 2013) .

The use of cooperative learning in the classroom as an instructional strategy has been a topic of study for many years. Cooperative learning simply involves groups of learners working together to accomplish a common task (Siegel, 2005). Students work together and pool their experience, strengths and skills that each team member brings to the group. This is usually done with groups of 2 to 4 students (Johnson & Johnson, 2005). When selecting group members, their size, weight and abilities should be taken into consideration in order to make the group heterogeneous within theirs, while they are homogeneous with respect to other groups. Members work together on a given instructional task until each member successfully understands and completes the task (Gull & Shehzad, 2015). This strategy produces higher performance results than students working alone. The instructor plays the role of determining lesson objectives, prepares appropriate material and explains the structure of cooperative objectives, organizes groups of students, reinforces students in necessary situations, and presents prizes to group members and active students at the end of the activity.

In cooperative situations, students retain more knowledge when they offer more explanation and elaboration to others (Zakaria, Chin & Daud, 2010; Webb, 2008; Johnson, Johnson & Smith, 2006). One of the benefits of cooperative learning is that the overall learning power of students is greatly increased

through group learning. Since all students have an active role, it is possible to acquire further mental development (Johnson and Johnson 2013).

Academic performance refers to some means of expressing a student's academic level (Joe; Kpolovie; Osonwa & Iderima, 2014). It is a measure of the understanding, quality and accuracy of test responses, the quality and accuracy of problem solving, the frequency and quantity of the desired result, time or rate of solution, level of reasoning and critical thinking, creativity, recall and retention, and task transfer. Academic performance can also be viewed as a subject grade, an average for a group of courses / subjects in a study program (Cary, David & Roger, 2008). There are two dimensions of academic performance namely: good performance and poor performance (Dimbisso, 2009). Good academic performance always leads to success while poor academic performance leads to failure. Each of these two realizations is experienced by students in one form or another. Academic performance is derived from certain motivational processes (Tella, 2007). The processes are intrinsic motivation which is based on internal factors such as self-determination, curiosity, challenge and effort, and secondly, extrinsic motivation which involves external incentives such as rewards and punishments. Some students study hard because they are internally motivated to achieve high standards in their work (intrinsic motivation) while other students study hard because they want to get good grades or avoid parental disapproval (extrinsic motivation). The academic success of students in any subject or profession depends on their interest (Kpolovie, 2010).

Motivation is generally defined as an internal condition that initiates behavior (Granito & Chernobilsky, 2012). Motivation moves humans. Motivation arouses interest.

Motivation creates the desire to achieve a goal. Teachers are always on the lookout for what motivates their students (Schuitema, Peetsma & van der Veen, 2016). Motivation is the key to students' academic success on the goal set by them or by the teacher (Theobald, 2006). Motivation is the driving force that stimulates reluctant students to learn. There are reluctant learners in every class. Reluctant learners are students who usually don't use to complete homework and sometimes skip homework. Reluctant learners find it difficult to cope (Sanacore, 2008). A common thread among reluctant learners is their self-perception, known as self-efficacy. If their self-efficacy is low, their motivation to perform will be low. When students are constantly berated by negative comments, their self-esteem and self-efficacy decline. Students' reluctance to learn is also affected by homework created by teachers. If a task is too easy or too difficult, reluctant learners are not motivated to solve the problem and succeed. Students are motivated when they feel excited about a task or feel that what they are doing is worth it (Linnenbrink & Pintrich, 2003). Creating activities that students enjoy and respond to is a difficult task for teachers of all subjects. Introducing technology-infused lessons can be a beneficial motivation for any grade level (Prensky, 2001; Atkinson, 2000).

Traditional teaching methods do not provide sufficient opportunities for learners to build their own knowledge. The mobilization of the individual abilities, intelligence and creative thinking of learners can only be achieved by using student-centered instructional strategies (Adegoke, 2011). Whitmore (2006) identified classroom modification and appropriate teaching methods as a real tool that can help reverse learner underachievement. Ogwo and Oranu (2006) believe that the teaching method adopted by the teacher to promote learning is of the utmost importance.

Therefore, Gordon (2009) argued that there is a need for teachers to use pedagogical strategies capable of sustaining the interest of learners.

Teaching a science subject like chemistry requires teachers to use instructional strategies that promote the acquisition of scientific knowledge (O'Donnell, 2000). Cognitive elaboration theory is one of the theories that emphasizes taking appropriate action that can enable teachers to more clearly explain teaching and learning content. Integrating technologies such as video, Facebook, and WhatsApp with a cooperative learning pedagogical strategy can create a wonderful classroom atmosphere where students become energetic and highly motivated to perform better academically (Slavin, 2011). The effect of gender on student achievement has been a topic of interest to researchers for some time. Gender is the set of physical, biological, mental and behavioral characteristics that differentiate the female and male population. Many researchers believed that gender could have an impact on students' academic success (Amosun; 2011; Adeyemi & Ajibade, 2011). The importance of examining students' academic performance in relation to gender rests primarily on the socio-cultural differences between girls and boys. Opinions vary as to whether male or female students perform better. Some believed that male students performed better, while others believed that female students performed better academically (Ofoegbu, 2008). Although some researchers found that there were no significant differences between male's and female's performance in math and other science subjects like chemistry across grade levels, most identified differences between sexes (Atovigba; Vershima; & O'Kwu & Ijenkeli, 2012). In fact, the general belief in most parts of the country is that male

students tend to perform better than female students in chemistry and technology related subjects.

Another area of interest for researchers around the world is the relationship between gender and the academic motivation of students. Different research has shown the existence of a difference in the motivation between students. Some researchers have pointed out that girls believe that it is their motivation to succeed that determines their performance, while boys believe that luck, not the motivation to succeed that is responsible for their academic success (Smith; Sinclair and Chapman, 2002). However, Amezucua and Pichardo (2000) stated that there was no evidence for the existence of a gender motivational difference in motivation between male and female students, as some researchers claim. The issue of gender is vital for this researcher because it is carried out in a mixed school.

1.2 Statement of the Problem

Poor academic performance of students in educational institutions in Nigeria is one of the biggest problems facing students and teachers, more especially at the secondary school level. Academic performance of students in Chemistry in Senior Secondary School Certificate Examination (SSSCE) has consistently been very poor and unimpressive (WAEC Chief Examiners' report 2007, 2012 and 2016). Poor performance of students in Chemistry can retard the phase of scientific and technological development of a nation. With increasingly poor performance of students in crucial science subject like chemistry, it will be difficult for Nigeria to be able to use her citizens to fully harness their skills in exploiting and utilizing her vast natural resources.

Over dependence of teachers on traditional methods of teaching in secondary schools in Nigeria may be one of the major challenges to our hope of being science and technology giant in the foreseeable future. In the developed nations, gone is the era where teachers use traditional methods to teach students, rather teachers employed computer based technologies that promote effective instructional delivery. Technology integration in different methods of teaching may be one of the answers to continuous poor performance of students.

In order to tackle continuous poor performance of students in chemistry, there is need to focus research from traditional method of teaching to technology based teaching strategy such as video, Facebook and WhatsApp based instructional strategy. It is also vital to conduct research that can help in determining the strength and weakness of each of the strategies on students' academic achievement and motivation. This can help teachers as well as educators in knowing the strength and weakness of each strategy as well as in determining the best strategy to be implemented in classroom instruction. It is against this background that the researcher investigated effects of three modes of cooperative learning strategy on chemistry students' performance and motivation in Kaduna Metropolis, Nigeria.

1.3 Objective of the Study

The main objective of this research work is to investigate the effects of three modes of cooperative learning strategy on chemistry students' performance and motivation in Kaduna Metropolis, Nigeria. The specific objectives of the study are to;

i. Determine the difference in the performance mean scores of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages.

ii. Determine difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages.

iii. Determine gender difference in the performance mean score of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages.

iv. Determine gender difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages.

1.4 Research Questions

The following are the research questions raised to guide the study:

i. Is there significant difference in the performance mean scores of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages?

ii. Is there significant difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages?

iii. Is there gender difference in performance mean score of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages?

iv. Is there gender difference in motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages?

1.5 Research Hypotheses

The following null hypotheses (Ho) were formulated and tested at 0.05 level of significance to guide the study:

HO_1: There is no difference in the performance mean scores of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages.

HO_2: There is no difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages.

HO_3: There is no gender difference in the performance mean score of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages.

HO_4: There is no gender difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional packages.

1.6 Basic Assumptions

The following basic assumptions are made for the study; that:

i. The selected teachers would have had some technology training since the computer technologies are available in the school.

ii. The students are literate in computer technologies and that the researcher will not face difficulty with the students during the treatment process.

iii. The secondary schools in Kaduna metropolis are equipped with computer technologies than those in the rural part of the state.

iv. There is gender difference in the motivation and performance of students taught using video, Facebook and WhatsApp based cooperative learning instructional package.

1.7 Significance of the Study

The result of the findings of this research may be highly beneficial to Chemistry

teachers as well as other science subject teachers, students, school administrators, parents, curriculum planners, future researchers and government.

The result of this work may encourage Chemistry teachers to use computer technologies (such as video, Facebook and WhatsApp) integrated in cooperative learning to improve students' understanding and performance. It may also serve as an eye opener to teachers in other science subjects as well as other fields of learning to explore and adopt better instructional approaches in handling difficult and abstract science topics and concepts in their own areas for improvement.

Secondly, the way Chemistry is hurriedly taught in secondary schools makes the subject matter irrelevant to the learner resulting in their inability to transfer learning to everyday life and poor academic performance. Thus the result of the research may help in improving students' performance in Chemistry and also ensure better quality Chemistry candidates for the Senior Secondary School Certificate Examination (SSCE) such as West African Examination Council (WAEC), National Examination Council (NECO) and Unified Tertiary Matriculation Examination (UTME) among others. This is because when students are exposed to video, Facebook and WhatsApp based cooperative learning instructional package, their academic performance may tremendously be enhanced. Again, the work may help to produce more qualified candidates that can easily secure admission to study science and technology courses in tertiary institutions of learning, which in turn may boost national economic growth and technological advancement.

The result of the findings of the research work may also be of great significance to secondary school administrators. This is because when teachers harness technology integrated in cooperative leaning instructional strategies, students are

expected to perform very well at both internal and SSCE examinations. And therefore, the school administrators may find this as a way out of the massive failure of students in Chemistry in various examinations. This may serve as an eye opener to school administrator as it may prompt them to see the need to train their teachers in computer technologies such as video, Facebook and WhatsApp based cooperative learning instructional package for effective lesson delivery.

Parents may tremendously benefit from the result of the findings of this research work. This is because students which are their children may perform better when they are taught chemistry using cooperative learning instructional strategy integrated with technology. Students may come out with good results at both internal and external examination which may pave them easy access to advance their studies at higher institutions of learning such as the Universities, Polytechnics and Colleges of Education among others. Therefore, parents may be relived from the re-registering their children at external examinations such as WAEC and NECO year after year due to consistent failure of their children. Students may no long have to write SSCE examinations multiple times before they are able to make it at credit level or above.

It may also sensitize curriculum planners about, superiority of technology integration in cooperative learning as one of the best alternatives to most widely used ineffective conventional methods. Attention of curriculum planners may be captured by the degree to which computer technologies embedded with cooperative learning enhances students' academic performance and motivation as compared to inappropriate and uninspiring traditional method of teaching that is responsible for poor performance of

students in chemistry as well as other science subjects, both at internal and external examinations.

The outcome of the findings of this research work may be of tremendous benefits to future researchers who may use it for various references works, more especially those who may carry out research work on use of technology integration in cooperative learning instructional strategies in Nigeria. This is because research on technology integration in Nigeria are very few, therefore this study may be a momentous asset to those who seek to embark on studies in other related fields in the near future.

Finally, the results of the study would also be of enormous benefit to the government. This is because for any meaningful advancement in science and technology to take place, the citizens of the nation must be given sound chemistry knowledge that can enable them to contribute in the nation building through application of their skills and knowledge in harnessing the abundant natural resources that the country is so much blessed with. Therefore, government may see the need to embark on mass training of teachers in technology integration not only in cooperative learning but also in other teaching and learning instructional approaches.

1.8 Scope of the Study

The study investigated the effects of three modes of cooperative learning strategy on chemistry students' performance and motivation in Kaduna Metropolis, Nigeria. Kaduna Metropolis was selected for the study because most of the schools where ICT facilities such as computer, mobile phones and internet services may be found are located within the city. There are three experimental groups in the study. This includes; video based cooperative learning instructional group, Facebook based cooperative learning

instructional group and WhatsApp based cooperative learning instructional group. Year two senior secondary school students (SSII) from three secondary schools in Kaduna Metropolis were purposively selected to represent each of the experimental groups. The selected secondary schools include; Excel Universal College Kakuri, Kaduna Capital School Malali and Command Secondary School Sabon Tasha. An air pollution chemistry topic was used as lesson the lesson topic for each of the three experimental groups. Air pollution was selected because it is part of the syllabus of SSII students and also because it is vast and appropriate for the nature of the study.

CHAPTER TWO
REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter discusses the literature review for the study. It is organized under the following subheading; conceptual framework; theoretical framework; empirical studies and summary of literature review. The conceptual frame work is a diagrammatic representation or expression of the variables that are involved in the research work. The theoretical framework reviews theories upon which the research work is based. The empirical studies presents quantitative results of findings of other research works in fields that are related to this research work, while summary of literature review presents summary of the chapter as well as pointing out the existing gap or the need for the study.

2.2 Conceptual Framework for the Study

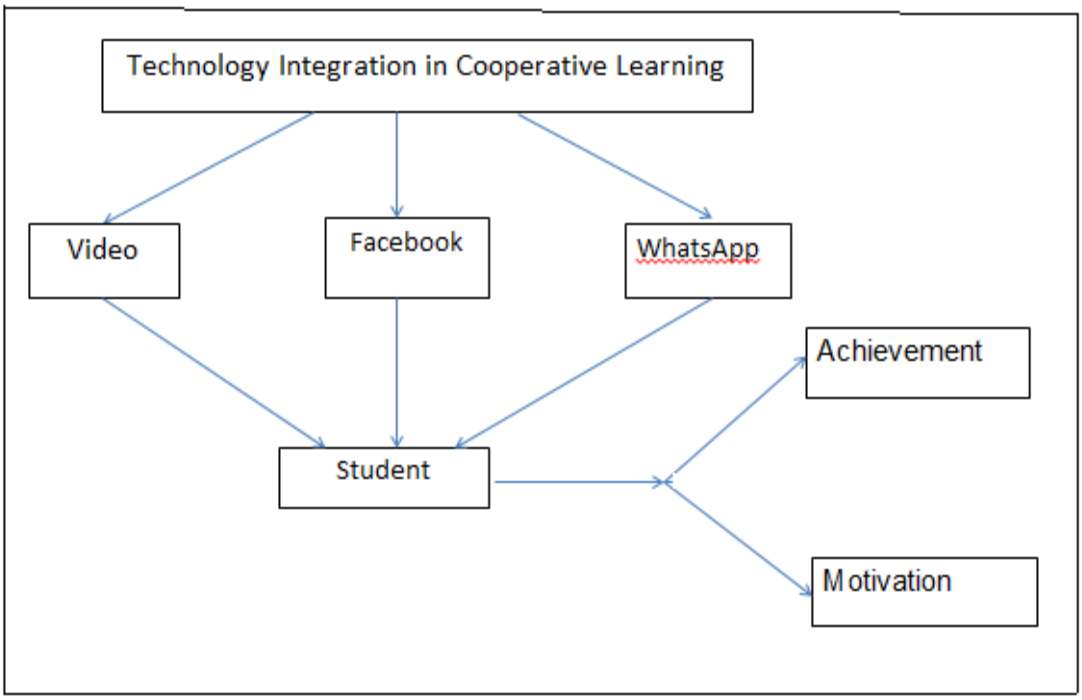

Figure. 2.1: Conceptual framework

As shown in figure 2.1, this research work seeks to investigate the effects of three modes of cooperative learning strategy on chemistry students' performance and motivation in Kaduna Metropolis, Nigeria. The technologies that will be integrated into cooperative learning include; Video, Facebook, and WhatsApp.

2.2.1 Technology Integration in Teaching and Learning

The technology integration is about using computers in the best possible way to provide learning content to students by the teacher and to help students acquire computer skills and use them meaningfully. Discrete computer skills gain new meaning when integrated into the school curriculum (Jonassen, 2000). Integration has to do with the use of computer technology for the delivery of instruction in a way that facilitates student learning. Eisenberg & Johnson, (1996) stated that technology integration involves using software supported by the business world for real world applications in order to allow

students to acquire computer skills in a flexible way.

Integration of technology is about making the program determine how computational technology is to be used, and not the computer technology to drive the program (Dockstader, 1999). Technology integration is about organizing the curriculum and technology goals in a well-coordinated and harmonious way. By integrating computer technology into the teaching and learning process, students develop computer skills by applying various computer skills as part of the learning process (Mullen, 2001).

Kent and Facer (2004) indicated that school is a vital environment in which students participate in a wide range of computer activities, while the home serves as a complementary place for normal engagement in a narrower set of computer activities. Increasingly, technology integration is being applied successfully in instruction, learning, and assessment. Technology integration is considered a powerful tool for educational change and reform.

A number of previous research have shown that an appropriate use of technology can enhance educational quality and connect learners to the real-life situations (Lowther, et al. 2008; Weert and Tatnall 2005). As Weert and Tatnall (2005) claimed, learning is an ongoing lifelong activity that enables learners to change their expectations through searching for knowledge, which departs from traditional methods. As time passes by, they will have to expect and be willing to seek out new sources of knowledge. Skills in using of technology integration will be an indispensable prerequisite for these learners. Technology integration tends to expand access to education. Through technology integration, learning can occur anytime and anywhere. Online course materials, for example, can be easily accessible 24 hours a day and seven

days a week. Teleconferencing classrooms allow both students and teachers to interact simultaneously conveniently and with ease.

Based on technology integration, learning and teaching no longer depend exclusively on printed materials. Numerous resources are abundant on the Internet, and knowledge can be acquired through video clips and audio sounds visual presentation among others. Research has indicated that technology integration assists in transforming teaching environment into a learner-cantered one (Castro; Sánchez & Alemán, 2011). Since learners are actively involved in the learning processes in technology integration classrooms, they are authorized by the teacher to make decisions, plans, and so forth (Lu, Hou & Huang 2010).

Betts, (2003) carried out research on technology integration contributions to quality learning in science at key stage 3 in the United Kingdom (U.K.). Data were drawn from test, interviews and observations. The researcher comes out with the following findings; technology integration offers particular opportunities to enhance learning by making more time available for predicting searching for explanations; technology integration allows pupils to work at their own speed; Lessons need to be structured according to the possible outcomes that a specific application of technology integration allows in other to take full advantage of technology integration. Belt's result suggested that technology integration can enhance the quality of learning where its use is tailored to lesson objectives and the needs of pupils.

Huppert et al., (2002) investigated the impact of a simulation on high school students' academic performance and their science process skills. The study focuses on the relations between academic performance, mastery of process skills, gender and

cognitive stages. The results of the research show that the performance of students using the stimulation was higher than those not using the stimulation, with girls achieving equally with boys. Stimulation was found to benefit students that have low reasoning abilities in particular, enabling them to be able to cope with learning scientific concepts and principles which requires high cognitive skill. A total of 181tenth grade pupils were sample for the research. The researcher was able to conclude that; Pupils in the stimulated learning environment exhibited complex and integrative reasoning; The simulation provided a self-paced, non-competitive learning environment which enable girls and boys to achieved equally; The simulation allowed repetition of experiments which in turn facilitate understanding.

Digital media can play essential role in helping students to learn better within a constructivist learning environment (Papert, 1980). Papert further believed that in order for children to build strong knowledge and skills, traditional tools such as pencils, copies and texts were inadequate. Computers are appropriate tools that can effectively help learners take control of the learning process and master skills and knowledge that can be useful to them.

There are a lot of factors that affect students' motivation to work and to learn. These may include interest in subject matter, perception of its usefulness, general desire to achieve, self-confidence and self-esteem, patience and persistence. With colourful and attractive graphics, interesting and illustrative animations, appropriate sound effects, technology integration provides multisensory stimulations and real-world experiences. Teachers using technology integration in teaching process can gain the learners' attention, motivate students to spend more time on learning activities

with greater concentration, and engage them through production work. Technology integration can extend the range of alternative teaching methods beyond the conventional classroom. Bransford et al. (2000) reported the pedagogical paradigm need to be focused towards student-cantered learning. He suggests four broad sets of changes that should accompany the integration of technology in instructional delivery and the move toward a constructivist methods of teaching and learning;

Changes in Teachers' Knowledge, **Beliefs, and Attitudes**: He stated the importance of changing teachers' beliefs and attitudes is to create long-term sustainable instruction system. Studies on technology integration find that projects fall short of expectations because the educators continue working within a traditional vision of rote learning. Teachers need to strongly believe that new approaches to instruction are effective and will make it easy for their students to learn and understand. Teachers' understanding and commitment are particularly vital in sustain changes in areas such as project-based learning or student-cantered techniques, which require core changes to a teacher's instructional practice (Gersten et al., 2000).

Changes in How Students Engage with Content: Research has shown that constructivist theories of learning has given a more reliable understanding of how humans learn than previous behaviourist learning theory. There are various constructivist learning strategies that can change the way students interact with the content (Windschitl, 2002). Introduction of technology integration into classroom instruction can change how students interact with the content through new types of learning activities.

Changes in Relationships among Teachers, **Students, and Parents**: Technology integration is essential in promoting a supportive and cooperative relationship between teachers and learners. Light (2007) claimed that the use of computer technology in learning environments changes teachers' and students' roles and relationships in the classroom.

Allow Investigating Reality and Building Knowledge; ICT enable students to analyse more thoroughly the important world around them. They will be more able to easily access information sources outside the classroom and may use tools to analyse and interpret such information. Information could also be accessed through online systems or through data logging systems. It also makes it easier for people to interact and gain expert knowledge within a really short time, thus making the acquisition of information to easily happen within a awfully short period of time (Amalnik, Moayyedi, & Mirzaei, 2015).

Active Learning and Authentic Assessment; ICTs has potential to offer increased possibilities for codification of knowledge about teaching and for innovation in teaching and learning activities by providing the ability to deliver learning and cognitive activities anywhere at any time (Larsen & Vincent-Lancrin, 2005). In many classroom situations it is difficult to permit students to be sufficiently active as participants. Typically students are often passive, spending plenty of your time listening or reading. It is well-known that students are more likely to develop interest and attention if they are being kept very active. Their engagement with the curriculum will increase as they are provided with opportunities to make their own information and represent their own ideas. Expert system will can be utilized to provide students with learning experiences where they can interact directly with the PC system, and not just to be passive but active participants within the

learning process, thus increasing the standard of education (Salekhova, Nurgaliev, Zaripova & Khakimullina, 2013). In line with Motamedi (undated), technology makes the learners take a full control of the learning process rather than taking passive role of receiving information from the teacher.

Engage Students by Motivation and Challenge; the interactive and multimedia nature of contemporary system has provided the chance for software developers to make increasingly more stimulating features. Computer systems can provide chance to form a large range of interesting learning experiences because it makes learning a social participatory process for supporting personal life goals and desires (McLoughlin& Lee, 2008). This can likely motivate students by increasing their interest in learning. The interactive and multimedia features within software are often accustomed to help students grapple with concepts and concepts.

Provide Tools to Increase Student Productivity; in the past students have spent lots of your time doing repetitive, low-level tasks particularly involving writing, drawing and computation. While it should be necessary for college kids to developing these skills at some times on most occasions they're pre-requisite to some higher level task. Unnecessary repetition of low-level tasks is inefficient, non-motivational and may jeopardize the main purpose of the educational activity. Many computer applications provide the tools to support students to quickly be able to complete these lower-level tasks so can be able to actively focus on the main purpose of the activity. Students can use Word processors, graphics packages, database packages, spreadsheets and other software to support their performance. ICT has transformed teaching and learning processes from being highly teacher-dominated to student- cantered, which can result into

learning gains for students, creating opportunities for learners to develop their creativity, problem-solving abilities, informational reasoning skills, communication skills, and other higher-order thinking skills (Bhaurao, 2015).

Increasing Learner Independence; Computer systems are increasingly getting used to produce learning experiences when and where they needed. This provides students with greater independence not only in terms of when and where they learn but also what they learn (Cradler & Bridgforth, 2002).

Collaborative and Co-operative Learning; the use of ICT results in more co-operation among learners within and beyond school and a more interactive relationship between students and teachers. It help students in not only in learning but developing respect the skills and contributions to their peers which is essential in facilitating the accomplishment of a selected end result or goal.

Tailoring Learning to the Learner; The programmability and interactivity which is possible with computer systems give opportunity to develop software which support the role of an instructor. Intelligent tutoring software may use information about the student to suggest appropriate sequences or sections of a tutorial for the student (Cradler & Bridgforth, 2002).

Overcome physical disabilities; Different input and output devices allow students with intellectual disabilities to participate in learning activities like any other student. For some students, computers provide an environment they can only control and are the only tool to reduce their disability. Modified Keyboard and mouse drivers can be used to make regular software packages available to students with severe disabilities. For students who cannot write while reading a lesson, the system is stored in a pre-recorded lesson library

to continue reading, providing an easy-to-use environment for blind students through translations of sound lessons.

Management of learning Experiences; managing quality education programs requires and generate many types of data. There are many activities that are time consuming which educators should consider the use of computer. These tasks include forming teams, overseeing library activities, writing reports, and organizing events. There are several school management packages that accomplish tasks like this and therefore free up full time for other important tasks. Schools need to take this opportunity to continue to provide effective solutions to problems related to school and learning management.

Assist Students in Accessing Digital Information Efficiently and Effectively; as stated by Brush, Glazewski, and Hew (2008), ICT is used as a tool for students to identify learning problems, solve them, and provide solutions to problems in the learning process to be carried out. ICTs encourage educational purchases and engage students in ICT practice while understanding their implications for the learning space.

Support student-centered and self-directed learning; Today, students use to heavily use computers in learning process (Sanchez and Alemán 2011). They build new knowledge by accessing, selecting, organizing and interpreting data and data. In relation to learning with ICT, students can use data from different sources to evaluate the quality of learning materials.

Produce a Creative Learning Environment; ICT deepens students' new understanding of areas of learning (Chai, Koh, and Tsai 2010). ICTs offer additional ways to find solution to variety of learning problems. For example, in classrooms, e-books are often used to read aloud. Students will be able to access any type of text, from beginner to

advanced users, via computer, laptop, personal digital assistant (PDA), or iPad. In particular, these books may include a wide range of reading applications that allow for reading, related writing activities, related games and reading skills, and vocabulary skills. Therefore, ICT includes structured applications that provide innovative ways to meet different learning needs.

Promote Collaborative Learning in a Distance-Learning Environment; Koc (2005) states that ICT will enable students to communicate, share and collaborate anytime, anywhere. For example, in a teleconferencing class room, students from all over the world can be invited to a meeting at the same time to discuss a topic. They can have the opportunity to explore problems, explore ideas, and develop ideas. You can then evaluate ICT learning solution. Learners not only shares knowledge, but also shares different learning experiences with each other, expressing themselves and reflect on their learning.

Offer More Opportunities to Develop Critical (Higher-Order) Thinking skills; Based on constructivism learning approach, ICT helps students focus on the most important tasks rather than meaningless task (Levin and Wadmany 2006). McMahon's study (2009) revealed that ICT promote acquisition of critical skills. When students are exposed to ICT environment for long time, it enhances their higher critical thinking skills. Thus, schools are strongly advised to integrate technology across all of the learning areas and among all learning levels. Where this is done, students are able to apply technology to the attainment of higher levels of cognition within specific learning contexts.

Improve Teaching and Learning Quality; As Lowther et al. (2008) have stated that there are three vital factors required to develop good quality instructional delivery with ICT. These are autonomy, capability, and creativity. Autonomy means that students take

full control of their learning through the use of ICT. In this way, they become more independent in learning by working for themselves and with others. Teachers can also organize students to accomplish a certain tasks with peers or in groups. Through collaborative learning with ICT, the students have more chance to build the new knowledge onto their background knowledge, and become more confident to take risks and learn from their mistakes.

2.2.2 Requirement for Effective Use of Technology Integration in Teaching and Learning

Research has consistently revealed that few schools and teachers implement ICT support to a level where the potential benefits are likely to be felt. There are a number of significant problems which prevent teachers from achieving the full advantage offered by technology integration. Cradler (2002) gave seven requirements for effective use of ICT in education: (a) Providing for both in-service and pre-service training**.,** (b) Ensure access to appropriate technology**,** (c)Provide for administrative support for technology use**,** (d) Suiting technology to education goals and standards, (e) Having a vision for the use of technology to support curriculum, (f) Providing time for teachers to plan and learn how to integrate technology**,** (g) Providing for on-going technique support for technology use**.** In general, these requirements fall into three areas of impact: (i) Providing the infrastructure of hardware and software, (ii) Providing curriculum and technical support for teachers, (iii) School organization, design, policies and practices, schooling, and management support.

There are four distinct characteristics of computer technology which have strong implications for computer usage in classroom logical programming, interactive control,

graphics and audio output, and information processing. There are various ways in which these characteristics can be used which if properly put into place can support students and teachers in improving their learning outcomes and increasing productivity. The degree to which each of these should be used will depend on any variety of variables such as the developmental age and characteristics of the learners, the qualities of the learning environment, and the nature of the curriculum content.

2.2.3 Factors Affecting Technology Integration Adoption in Schools

Adoption of ICTs in schools could be affected by many factors. These include contextual factors and psycho-sociological factors (Kozma & Anderson, 2002; Kumar, Rose & D'Silva, 2008). Psycho–sociological factors has to do directly with how the educators use of technology – this could be psychological and/or social. Contextual factors is the aspects of the environment in which the ICT is being used.

Educators' level knowledge and willingness to adopt ICT is often associated with sociological factors such as teaching experience using ICT and age (Cox & Marshall, 2007). Educators' approach to method of instruct may have an impact on whether the technology could be integrated into the instructional delivery process. If an educator believes in and holds on to conventional methods of teaching, he/she may not be likely to change his/her teaching method to embrace ICT. Conversely educators with belief systems more attached to constructivist principles may likely view learners as active participants in the learning process and therefore, readily embed ICT in their teaching and learning practices (Fredriksson et al, 2007; Niederhauser & Stoddart, 2000).

Different learning environments bring about different problems in implementation and use of ICT within the pedagogical practice. For example, in a

classroom situation, one of such factor is the ratio of students to the number of available computers in the computer laboratory. A high learners-to computer ratio results in less access to the computer per learner and may result in few learners that seat close to the computer dominating the use of a computer while the others simply watch passively. This may result to inefficient teaching and learning since not all students may equally benefit from the computer (Pelgrum, 2001).

Infrastructure is another big problem affecting adoption ICT in schools. The infrastructure required for the using ICTs in teaching includes physical electricity, space, furniture, and internet connectivity (Gulati, 2008). Though the availability of such ICT infrastructure may not be a challenge in developing countries or in schools in affluent areas, their availability or ease of acquisition in schools that are disadvantaged is not guaranteed (Obijiofor, 2009). Without a constant and reliable electricity supply, it is hard to run ICT facilities effectively and regularly. The institutional management also plays vital role in the adoption of ICT in schools. In environments where there is a top-down management style with little collaboration between different levels, staff members feel coerced into using ICT and therefore do not use it effectively (Czerniewicz & Brown, 2009). Staff members feel forced by a lack of institutional support and vision and many feel unsure of the direction they should follow and the purpose that the use of ICT is meant to serve. In addition, research has shown that the vision, leadership, and management provided by well-managed institutions enable employees to use modern communication technology more effectively than employees of institutions that are not managed very well (Czerniewicz and Brown, 2009).

The socio-economic context of the learner

may also affect adoption of ICT technologies in school. In affluent settings, a lot of learners may have access to computers at home, and should therefore be proficient with the use of the technology within the school environment (Muller et al, 2007). In contrast, many learners that are schooling in disadvantaged areas may not have these amenities at home and, therefore, may be less familiar with their use. Such learners will have a low tendency to the use of the computers (Bovee et al, 2007). This agrees with Chigona et al (2010) when they claimed that most of the students in disadvantaged schools do not have computers at home therefore they are introduced to such technologies for the first time at school. Similarly, educators who come from less advantaged socio-economic background are less likely to have computers in their home. Since they may less likely going to be constantly engaged in using a computer, their skills can be less advanced compared to the users that are more regular. According to Chigona et al (2010), some educators consider the ICT as not necessary but add-on to their teaching skills and therefore cannot be fully integrated into the instructional delivery. Brooks and Brooks (1999) believe that many educators perceive computers as just another burden, commenting on teachers' lack of awareness of the possibilities that computers offer from an educational point of view. He states that education has resulted in limiting the possibilities of computer use for processing and email. Other researchers, such as Pascopella (2001), argue that some educators feel that computers are just a form of recreational activity. For example, learning to play games after computing. However, Potoski and Boboko, (2001) have shown that the use of computers has a positive effect on learning and education.

Teachers Training in Technology Integration Use;Hawkerin (2001) analysed the relationship between teacher skills in the use of the new ICT. Their teaching thinking and

self-reported methods. The results showed that only a small percentage of teachers have sufficient ICT skills. In addition, Wayne (1993) suggested that lack of early teacher training was a serious obstacle to ICT implementation.

Access to Technology Integration and other Related Infrastructure; Cuban (1993) suggested that putting computers within the reach of teachers and in supportive school cultures was very important for teachers and students to enhance their ICT potential. This point of view was supported by, Preston et al, (2010) in their study conducted to examine the factors related to the adoption of ICT in learning. The results showed that teachers who regularly use ICT have confidence in the use of ICT, they perceive them as useful for their personal work and for their teaching.

Administrative Support of Technology Integration in Schools; According to Anderson and Dexter (2000), unlimited access to training would equal efficient use of computers if teachers are expected to use ICT in a meaningful way. In this sense, they suggested that strong leadership is essential to integrate IT and implement ICT in teaching and learning in general. However, many managers and administrators are not fluent in ICT, believing that they have acquired little experience or knowledge that requires them to use computers only for basic functions such as word processing and PowerPoint presentations.

2.2.4 The Need for Technology Integration Application in Nigerian Secondary Schools

Improvement of secondary education is necessary for the creation of effective human capital in any country (Ivoh, 2007). The need for ICT in secondary schools in Nigeria cannot be overemphasized. In this era of high technology, in order to survive,

everyone needs knowledge in the field of ICT. Organizations find it necessary to train and retrain their employees in order to gain or increase their knowledge about computers and other ICT devices (Adomi & Annie, 2006; Tyler, 1998). This requires students to acquire ICT skills as early as possible. The ability to use computers effectively has become an integral part of every person's education. Skills such as accounting, clerical and administrative functions, inventory control, etc. now constitute a cluster of computerized practices that make up the main suite of IT skills: spreadsheets, word processors, and databases (Reifel & Whitworth, 2002). ICT literacy in Nigeria is increasing as employees understand that computers and other ICT devices can improve efficiency. On the other hand, employees have also realized that computers can pose a threat to their work, and the only way to improve work safety is to become computer literate. Due to the high demand for computer literacy, teaching and learning of these skills is a concern for professionals. This is also true for other ICT components.

New teaching techniques using ICT provide a variety of tools. For the student, the use of ICT allows them enhance their personal ability to learn. In schools that use new technology, students have access to tools that are flexible and provide valuable and instant feedback to enhance literacy, which is currently not implemented fully in Nigerian (Emuku & Emuku, 1999 & 2000). The application and use of ICT is beneficial for improving the education system in Nigeria and for better education of students. The technologically advanced workforce will lead the development of ICT in Nigeria, with military technology and telecommunications, media communications, and skilled ICT professionals equipped to solve IT problems in Nigeria and the rest of the world (Gosht, 2006). The Nigerian

education sector is in a process of change, indicative of a certain level of ICT use in secondary schools. The Federal Government of Nigeria's National Education Policy (Federal Republic of Nigeria, 2004) recognizes the prominent role of ICT in today's world and has integrated ICT into education in Nigeria. To achieve this goal, the document states that the government will provide basic infrastructure and education in elementary schools. In the lower grades of secondary education, computer education has been converted into a provisional career option and in the upper grades of secondary education into a career choice.

The government also intends to provide the necessary infrastructure and training to integrate ICT into the secondary school system. It should be noted that 2004 was not the first attempt by the Nigerian government to introduce computer education in schools. In 1988 the Nigerian government passed a computer education policy. It was planned to set up pilot schools and to spread innovations in computer education first to all secondary schools and then to elementary schools. Unfortunately, beyond the distribution and installation of PCs, the project has not found widespread acceptance (Okebukola, 1997; cited by Aduwa & Iyamu, 2005).

Okebukola (1997), quoted by Aduwa-Ogiegbaen and Iyamu (2005), concludes that computers are not part of classroom technology in more than 90% of public schools in Nigeria. This means that blackboards and textbooks continue to dominate the classroom activities of most secondary schools in Nigeria. The Federal Ministry of Education has launched an ICT-focused project called School Net (Adomi 2005; Okebukola, 2004) aimed at equipping all schools in Nigeria with computers and communications technology. At the World Economic Forum's Africa Summit in June

2003 in Durban, South Africa, the New Partnership for Africa's Development (NEPAD) brought computers and, among other things, radio and television, telephone and fax, to all African high schools. It also aims to connect African students to the Internet. The NEPAD Development Initiative will take place over a decade and the high school components will be completed within the first five years. Three phases are envisioned, each phase containing 15 to 20 countries. The phase is shifted and it is expected that about 600,100 schools will benefit. The purpose of this initiative is to equip young Africans in elementary and junior high school with ICT skills and to utilize ICT to improve, enhance and expand education in African countries (Aginam, 2006).

The Nigerian federal government has commissioned a Mobile Internet Unit (MIU), which is administered by the Nigerian National Agency for Information Technology Development (NITDA). The MIU is a locally made bus that has been converted into a mobile training centre and cyber centre. Inside there are ten workplaces, all of which are networked and connected to the Internet. The MIU is also equipped with printers, copiers and a range of multimedia facilities. The internet is provided via VSAT with a 1.2 m long satellite dish on the roof of the bus. It is also equipped with a small electrical generator to ensure a regular power supply. MIU brings the Internet to places and various elementary and secondary schools (Ajayi, 2003). However, the number of buses is so small that most rural areas and schools are not yet covered. Although efforts have been made to ensure that ICT is available and used in Nigerian secondary schools, adoption rates are still low. Goshit (2006) found that most private and public schools do not offer ICT training programs. NEPAD rated the level of experience and use of ICT by African

students as very low. 55% of continental students including Nigeria, Algeria, Burkina Faso, Cameroon, Congolese Republic, Egypt, Gabon, Lesotho, Mali, Mauritius, Mozambique, Rwanda, Senegal, South Africa and Uganda (the first phase of the Electronic NEPAD School), they Said he had no computer experience. Other findings show that typical African school environments do not provide opportunities or guidance regarding the use of ICT, and 75% of teachers who respond have little or no experience and knowledge of educational ICT applications.

Okwudishu (2005) found that inaccessibility of some ICT components in schools hindered teachers from using ICT. Lack of proper search skills and hotspots in schools has been reported to prevent secondary school teachers from using the Internet (Kaku, 2005). Most secondary schools in Nigeria do not have ICT equipment, forcing students to rely on Internet cafes to access the Internet (Adomi, Okiy & Ruteyan, 2003).

2.3 Concept of Cooperative Learning

Cooperative learning is the intentional use of small groups of students by the teacher. Members of each group work together to maximize understanding of the learning task. Nnaka (2006) sees collaborative learning as a successful learning strategy in which small groups of students of different ability levels use different learning activities to improve their understanding of a topic or subject. A teacher using a collaborative learning strategy brings students together in small groups. Each group should be diverse in skills and sociocultural backgrounds. They work together to complete a given learning task until each participant understands and completes the task. This is in line with NTI's (2006) view that cooperative learning is a learning model in which learners interact with

each other to complete or complete a specific task, usually in small groups of four to six people.

Anakeway (2006) reported, however, that cooperative learning differs from normal group work in the classroom, in that the teacher instructs his students to work together in small groups either because of convenience or because of insufficient materials or large class sizes. A group that is often formed on the basis of men, women, friends, etc. and is not based on formal norms contradicts the spirit of cooperative learning. The teacher takes the position of moderator, but stays in the background, allowing students to actively discuss and debate issues. Children should be grouped and encouraged to contribute individually to problem solving.

Onijekwe (1996) suggested how to plan the cooperative method in such a way that a satisfactory result is obtained. The teacher has to decide whether the problem in question can be solved cooperatively in a satisfactory manner. The teacher needs to ensure that the students have sufficient facts on the subject so that they can discuss and debate appropriately. The teacher should also ensure that the group work is not dominated by talented or meritorious students, but rather that every member of the group is given equal opportunity to come up with ideas. For cooperative learning to be effective, Anakwe (2006) listed six teacher and nine student characteristics as required: The teacher should:

(a) Assign the learners to their groups; noting the critical variables: ability, sex
(b) Outline tasks/skills to be learnt very clearly for instance, hands- on activities, process skills, estimation of size, volume.

(c) Assign function to group members (which must be varied on every new task/exercise)

(d) Ensure conducive class room environment (space and needed materials)

(e) Plan ahead to direct learners on materials to improvise for the next day's work for instance, Potted seedling

(f) Create opportunities for general class discussion and expression of ideas.

Students must: (a) work in small groups of 4 to 6 students; (b) work in a group of mixed ability in terms of performance; (C) work in mixed groups (men and women in groups; d) work as a team; (e) contribute ideas and suggestions together; (f) make decisions by consensus; (g) with completed assignments and class work together. (h) Seek help primarily from group members; (i) Receive rewards as a team, not as an individual. Nekway (2006) also identified four steps to follow to apply cooperative learning.

(a) Use previous students' achievement to group them in manageable groups of between 4 and 6 of mixed ability rating.

(b) Make students understand what is expected of each member of the group and what the cooperative learning is all about.

(c) Ensure the availability of all instructional materials needed.

(d) Introductory session to the topic/lesson followed by outline of the tasks/skills to be learnt.

Kagan (2004) suggests five elements of cooperative learning to include:

Positive interdependence: Each member of the group has a unique contribution to the overall success of the group and the effort of each member is indispensable. The group members sink or swim together.

Face to face interaction: Each member explains how to solve the problem, share their knowledge and ideas, review the understanding between the members, and connect with past insights.

Individual and group accountability: Each member is responsible for the success or failure of the group. No hitchhiking and social laziness for the task at hand. Therefore, the teacher should ensure that each member of the group is evaluated and verified by encouraging each to present their group work and assigning one group member the role of reviewer.

Interpersonal and small-group skills: Social skills such as leadership, decision-making, trust-building, communication and conflict management must be acquired.

Group processing: members analyse their actions and in terms of which one is helpful or not helpful and how well the group has achieved their goals.

Teaching together is not just about having students divide into pairs of four or six for the exercise. Actions are planned and monitored in advance to ensure that already defined goals / objectives are achieved. Anaekwe (2006) listed some of the benefits of using collaborative learning strategies in science, math and technology as follows:

(a) Enhances students' achievement and interest in learning concepts;

(b) It promotes group cohesion, peer-support, learning interdependence, self-esteem;

(c) It enables non-mainstreamed student to accept their mainstreamed classmates, thereby erasing petty Jealousy among bright and dull students;

(d) Cooperative efforts result in participants striving for mutual benefit so that all group members: Gain from each other's effort; Recognize that all group members

share a common fate; Know that one's performance is mutually caused by oneself and one's team members;

(e) Feel proud and jointly celebrate when group member is recognized for achievement.

However, researchers such as Martins - Umeh (2009) and Onijekwe (1996) cautioned about the cautious use of the Cooperative approach due to the following shortcomings: Cooperative learning prevents bright students from speeding up when they master concepts. Then, an inexperienced student may dominate the hesitant, and some students will naturally want to work on their own and not be able to freely enter into collaborative conversations. It is therefore cautioned that collaborative learning is not always appropriate as a standard method. Therefore, effective chemistry teachers should be generous in their choice of teaching method. Therefore, cooperative learning is a new instructional method that, if worked carefully, may be able to solve some instructional problems.

2.4 The Use of Video in Instructional Delivery

Video usage currently dominates Internet bandwidth. Cisco 2 'Globally, total Internet video traffic (business and consumer combined) will be 77% of all Internet traffic in 2019, up from 59% in 2014.' High-quality video can be quickly streamed on mobile devices during an educational event. Downloading the song online took 12.5 minutes in 2002, but in 2014 it only took 18 seconds. This staggering statistic is striking when YouTube reports that '300 hours of video are uploaded to YouTube every minute' (Greenberg & Janetis, 2012). A key goal is to empower students and engage them in the learning process, and video is clearly an instructional medium that generates a greater

amount of interest and enjoyment than most traditional print materials.

Using visual and sound, video is the ideal medium for students with auditory or visual learning. With the additional use of captions, each child has the option to watch, listen to, or read each presentation. The video encourages and engages students to generate and sustain interest for a long time, and provides innovative and effective tools for educators to broadcast and deliver essential curricular content. Research has shown that video can be the most effective way to enhance a lesson or study component. Video should be used as a component of instruction in conjunction with other available resources to teach specific content. Teachers.

Video has changed dramatically over the years. When the format of the video was a physical videotape, watching the video was banned by a physical copy of the videotape (Petman, 1989). A teacher could take a video from the library and play it back to class on television. This required proper planning, ensuring the availability of adequate equipment, and some technical challenges in ensuring quality and image display. Today, video display has become easier in educational contexts. By adding a hyperlink to a video in the course content, a teacher can easily share the video content. However, in many online courses, video production remains a viable option (Hans et al., 2015). Aspects that can make video production less expensive will continue to increase its use in education (Beckel and Groot Cormelink, 2011 Sonic Foundry, 2013). In the last decade, video production has gone from a small group of professionals to the general public. Anyone with a mobile phone can now record videos. In the past, this process required specialized technicians with specific knowledge and access to expensive specialized video equipment, file

processing and transmission. Today, mobile devices such as smartphones, digital devices, iPads, and digital cameras have standard options for recording video in ever-increasing quality. Recorded video files can be instantly uploaded to social media or cloud servers via Wifi. Some American universities (such as Pennsylvania State University) have developed a "video box" that allows "self-service video recording." Instructors and students can instantly record video using slides by simply plugging in the USB. All complex technical issues, such as audio quality, lighting, and loading on a server, occur invisibly. The studios are so easy to use that they have grown from 80 students a year to recording to 4,500 a semester. Virtually no training is required.

It can be said that today we have entered a new phase in "video era". Students can instantly shoot everything, including recording their class (Race, 2013). An example of the ease of recording and sharing information is the Future Lecture Monkey application lecture. Downloading this application turns a student's iPhone into a lecture capture camera, and instantly translates classroom and lecture contents into a shared file. Students will work together to take notes while commenting in bulk during or after a short editing session. Comments are collected, shared and become a natural part of the lecture flow. Lecture Mankey requires students to always check the institution's rules for recording and sharing the contents of the lecture, but it is not clear whether these protocols are always followed. In this context, video lecture materials can be prepared by students in a variety of formats and shared on digital networks.

2.4.1 Types of Instructional Video

2.4.1.1 Live Lecture Capture

Recording live lectures can be the first step in video teaching. It involve the use of

a camera in the auditorium and the instructor giving his traditional lecture in front of a live audience. The conference will be recorded for future playback. Deal (2007) describes live conference recording as webcasting and defines five processes. Classroom presentation, classroom recording, processing and editing, hosting, distribution and playback. Brotherton and Abowd (2004) describe this as webcasting, which attempts to capture temporary and transitory information such as conversation and writing on a whiteboard while combining it with slides that can be accessed later. According to Germany (2012), live conference recording can take place in the form of automatic recording of the conference room environment, including the teaching area (whiteboard, smart whiteboard, PowerPoint screen, audience). It can be created with one or more cameras (no technician or student) or with a technician guiding the camera to follow the action and film both the instructor and the audience.

Conference capture is a recorded conference that uses: Computer technology to facilitate automatic capture and integration and access to the media (whiteboard, electronic whiteboard, presentation software, etc.) used during a conference. The conference determines the duration, content and structure. An increasing number of universities are supporting their students by making lecture recordings available online. The recordings are aimed at remote or part-time students, as well as full-time students on campus who were unable to attend the live lectures (Ramaswam, 2009).

The web conference recording process begins by simply placing a video camera in a standard conference and recording it. However, as this pedagogical development has become widespread, it has become clear that it is necessary to develop different pedagogical styles to increase the effectiveness of this format (Guo et al., 2014).

Sonic Foundry is one of many companies that produce the technical systems for conference capture and had about 40% of the market share of web capture technology in 2009 (Ramaswam, 2009). They describe lesson capture as follows: Recording classroom activities in a digital format that students can view on the web, on a computer, or on their mobile device. Conference capture technology records the presenter's audio and video as well as all visual aids (laptop, tablet, whiteboard, document camera), syncs them, and plays the live stream or file for a reading upon request. The term course capture is sometimes known by other names, including `` E-learning, video teaching, online courses, blended education, hybrid courses, distance learning, course delivery, virtual classrooms, learning environments, virtual learning, academic capture and more. There are several other companies that produce technical recording equipment for conference capture such as Presentations2go26 and Echo 36027.

2.4.1.2 Screencasts

Screencast is a digital film in which the stage is partially or totally a computer screen, and the audio presentation describes the action on screen" (Udell, 2004). There are many different types of screencasts that serve different purposes; Tutorial, short tutorial, interactive demonstration, featured article, animated whiteboard, software review, Screencast enhanced video and Conceptual Screencast (Greenberg & Janetis, 2012; Kaumi, 2014; Moyle, 2010; OASE, 2011). Ramaswam, (2009) sees Screencasts as a modification of the web conference that focuses on "what happens on the screen, for example, to explain the use of a website". Screencasts can contain video of the presenter, but generally only contain audio and screen recording.

Green, et al (2008) describe screencasting as 'video that can

capture the output of a computer screen with concurrent audio definition', a technique originally used for tutorials and software demonstrations, but later adopted by teachers to support the student learning. The term screencast has many other names, such as desktop video captures, online tutorials, and screenshots (cited in Betty, 2008 Sugar, Brown, and Lutterback, 2010). Many screencast software tools are free to download and relatively easy to use, such as Screencast-O-Matic 28, Jing 29, Screener 30 or Screencastcom 31. There are also commercial options such as Camtasia Studio 32. Contrary to the definition given above, screenshots usually contain only audio dio, all screenshots listed here have the function of capturing a teacher's video through a web camera. Screencasts can be done quickly, at almost no cost and on any device with the right software. It can be an instructor video or just an audio dio description that directly captures on-screen activity, including mouse clicks and other activities. It is also possible to screencast only a specific part of the screen. Screencasts can be made immediately available on a public server, or edited and then distributed via other (secure) channels. The uniqueness of the screencast means that it is particularly suitable for explaining and illustrating a series of steps in a series of (computer) screen formats. Accordingly, each screencast software option uses the screencast format to explain and demonstrate how to use the explain software. Screencasts can also be used to respond to student documents, increase engagement and participation, and save the instructor time (Budoin, 2014).

It's easy to learn how to do a screencast experienced by a current researcher. The software can be downloaded in seconds and a high degree of plug-and-play leads to instant results. For the speaker, the screencast can be seen as a step beyond Skype or FaceTime, as it requires a certain

degree of planning and scripting, no live feedback or interaction with the student and teacher audio dio (and often a video screen image) is not recorded. Because screencasts can only be audio dios, it can be a good place to practice "recording" the learning process in non-conferencing where only audio dios are captured. In the case of Skype or FaceTime Communication, the student may choose to record the audio Dio of the communication, but the actual video image of the teacher is usually not recorded and is temporary. After using Skype communications with students, creating a screen due to the low barrier to technology entry and its informal nature is an ideal first step in teaching video.

2.4.1.3 Web Lectures

Web lectures are defined as 'condensed, studio-recorded lectures', which are available from the web as multimedia presentations that integrate lecturer, audio dio, lecture slides and table of contents (Day, 2008). Web lectures are usually divided into two screens. Screen 1 is a screen where the teacher's video image appears, his video being taught. Screen 2 introduces content that visually supports the information presented in Screen 1. It can be in the form of a PowerPoint presentation or written on a smart board. As teachers lecture, the software records the teachers on screen 1 and synchronizes them with the content of this lecture on screen 2. Web lectures differ from live lecture captures, which are created without a live audience, with technology that can be recorded in the studio (or a teacher's office fee).

Teachers can use the software to record their own web lectures without the help of experts. InHoland Lectorate conducted a pilot project (May 2015) to explore how teaching, learning and technology can introduce new self-recording web lecture software

to the organization. Through workshops and training sessions, six technology pioneers (one from each department) supported and trained a group of staff to use My Media Software. The software allows lecturers to record their own content (web lectures, screenshots, slideshows) from behind their computer.

Web lectures are usually shorter than traditional lectures (Day, 2008; Philius and Lam, 2009, 2010). Ramaswamy (2009) adds that web lectures have studio recordings that combine video and video dio with a synchronized view of the instructor's computer screen while watching a presentation. Web lectures usually last no longer than 20 minutes. Web lectures can be as short as 20 minutes. In this case, they can be called micro-web lectures or knowledge clips, and they usually focus on a specific topic. The recording process for the web lecture takes place "behind closed doors" of the recording studio. It is a private and singing recording process between the teacher and the technician. There are multiple takes and if the teacher makes a mistake they can re-record the lecture, an option that is not possible during a live lecture. The presence of technology and a "live" recording studio can put extra pressure on the instructor and create extra "nerves" during the recording session. Traditional education takes place "behind the door of the classroom" in groups of students. Web lectures are often recorded behind the studio door, but are recorded "privately" with a technician. Instructors can also use software such as Micromedicite 35 and Chemtasia 36 to record web lectures without the help of technicians. It can reach a much larger audience than previously invincible within the physical limits of the classroom. Web lectures can be based on established lecture maintenance (for example, instructors use the same content and PowerPoint slides as standard like lectures). Alternatively, you can customize standard content / slides into

your web lecture. Once video education has been recorded and made available to students, students will have access to a number of options for viewing. You can choose between full screen talking heads (1 screen only), talking heads and slides (screen 1 and screen 2), and only slides (screen 2). You have the option to use slide navigation (up to half normal speed) or fast (twice normal speed), pause, pause, and move back and forth. Video software can be viewed on your personal device using the appropriate software. These options allow students to customize the media-based approach and the playback experience based on their individual learning preferences (Sonic Foundry, 2014).

Web conferences can be interactive. Students and teachers can enrich content with social tags that indicate important sections or add topic headings to guide the viewer to relevant information faster. This can act as a way of taking notes that can help students in their learning process, leading to better results. Gua et al (2014) found that the use of web conferencing in combination with mind maps can promote meaningful learning. Examining the viewing logs of students who viewed web lectures can also indicate which parts of the recording are viewed the most. This may indicate a difficult or important topic, or it may indicate that the speaker did not explain something clearly. It is also clear from these journals how much student interest and attention has been lost (Guo et al., 2014). Adapting to teaching via web conferencing requires adjustments in the 'pedagogical approach, including the need to' visualize 'the student audience (as they are not present in the study). It is also important to have a clearly defined structure and provide information in a concise manner (Guo et al., 2014). By its very nature, a web conference must be carefully planned and structured in advance. This

process can be assisted by using scripting techniques to write and describe what will be covered in each section of the lecture.

2.4.1.4 Flipped Class Room

The flipped classroom is a component of mixed learning and is in stark contrast to the traditional classroom. Students do not listen to lessons in the classroom but outside the classroom via video online video conferencing (Millard, 2012). Teachers record themselves explaining the topic or get videos from a free website like YouTube to share with students to watch outside the classroom. The Verdi class has many advantages; Students become more motivated and confident when discussing in class as they prepare by watching video lectures before coming to class, class activities become more student-cantered rather than teacher-cantered because teachers act only as a convenience (Milman, 2012)). However, flipped classrooms also have some drawbacks. This is a new model of learning and not all teachers and students are ready to apply it (Roths, 2014).

2.4.2 Benefits of Instructional Video

Several potential benefits of using video learning in the classroom process have been identified. Some benefits have been supported by research while others are opinions or beliefs that require more research. Preston et al. (2010) suggest some conditions under which they see an added value in using video lectures (large class sizes, which students cannot attend for valid reasons, students who are looking for flexibility, and those who Students are not native speakers of language, they are instructions) They also suggest situations where it is inappropriate to use these formats, such as: for example, when face-to-face teaching is used for problem solving, When copyright issues can be a factor, or when the content of the lecture is sensitive or disruptive.

Yousef et al. (2014) examined 67 peer-reviewed articles from 2003 to 2013 related to video-based learning and concluded that the use of videos in the classroom can improve learning outcomes as well as learning satisfaction. Martyn (2009) points out that the impact of video on learning outcomes could be significant and warrant further investigation. Ramaswam (2009) found evidence that studying lectures recorded during exam time increases the probability that students will pass the exam, although they suggest that these results could be due to more active students studying web lectures.

Greater Availability Makes Content Accessible to a Diverse Student Population; Marinissen & Gratama (2012) suggest that alternative approaches of delivering material can offer good options to reach students of different levels. Several Colleges and Universities have implemented live lecture capture with the specific intention of making lesson content available to students with disabilities (Reece, 2013).

Cost effective, Time Efficient and Enjoyable for Students; once the video material is created, it can be reused in later lesson cycles through lectures (or companion lectures). And it can be seen many times at student-friendly pace and time. Dey (2008) found that the web lecture format was cheap and easy to implement, while increasing students' engagement and turning the classroom into a place for active learning. This gives evidence that the Constitution was effective and the students found it enjoyable. Moving more classes online can also be cost effective.

Freeing up in-Class Time for Interactive Learning; Day (2008) found that "in the light of the theory of modern learning, the practice of more than one traditional conference in most classrooms is probably not the most effective." This claim can be attributed in large

part to the lack of learner engagement in the context of the often inactive course. Longer lectures that convey a large amount of information are less and less relevant to students' current learning aspirations. Improper use of teaching resources has led to questions about the function of lectures that typically focus on lower-level learning goals (Preston, et al., 2010; Wu et al., 2008).

Day (2008) found that the use of video could be a way to reduce the cost of information transfer in the classroom and to increase the available classroom for further learning engagements in the active construction of learners' 'knowledge'. Provide convenience. This time can be used to engage students directly in relevant learning activities (Bishop and Verlager, 2013) "The extra classroom time available through online conferencing, answering questions, discussing difficult topics Can be used to do and engage in meaningful activity "(Yum, 2008). Social tagging can help students create teacher-interaction and help teachers understand which parts of their teaching are clear and effective.

Video training can play a role on many levels of e-learning and can be used as a dissemination of information, creating interactions in the learning process, and as part of the collaboration process. The e-learning aspects presented by Franson (2006) can be applied to three types of video teaching and traditional lectures.

2.5 The Use of Facebook in Instructional Delivery

Facebook is a giant social networking site created by Mark Zuckerberg in 2003. It is considered as the most popular platform for online social networking among college students. The success of it has been phenomenal (Vivian, 2011). Mostly used by students to create Facebook groups intended for their class course or subject to communicate as a

whole. In recent years, social networks have been widely accepted as efficient platforms for academic communications, especially on university campuses. According to Blattner & Fiori (2009), Facebook is the largest social network that boasts more than 100 million members, and it is one of the fastest-growing and best-known sites on the Internet. As McLoughlin and Lee (2008) pointed out, Facebook has multiple functions of communications, information sharing, and collaborative construction and modification.

Although Facebook initially appeared, the main reason students used Facebook was to keep in touch with their friends (Allison, Stanfield and Lampe, 2007; Vodziki, Schwamlin and Mosclick, 2012). Roblier, Mani Cadaniel, Webb, Hermann, and Whitty (2010) found that students preferred to interact with teachers through Facebook, rather than traditional face-to-face interactions.

Mazman and Usluel (2010) recognize that Facebook offers three types of educational features: communication, collaboration, and resource / content sharing. Communication includes activities such as ensuring communication between students and teachers, facilitating classroom discussions, completing homework and teacher assignments, and notifying about resources and links related to the course. It consists of activities such as connecting people to a school, faculty, or academic group associated with a class, sharing homework, projects, and ideas for group work. Collaboration consists of activities such as multimedia resources, video, audio, animated videos, resources, and document exchange.

2.5.1 Benefits of Facebook to Teachers

Teachers can get many benefits from using Facebook. For example, it can help teachers engage students outside of the classroom (Pilgrim & Bledsoe, 2011). Trainers

can also use this tool to learn about trends and issues in secondary education and get ideas for classroom practice. Although Facebook is widely known as a digital communication tool, it is also an information gathering tool, providing powerful professional resources for English as a foreign language educators (Kabilan, Ahmad & Abidin, 2010). However, these are not the only benefits Facebook offers teachers.

Many educational organizations such as the International Reading Association (IRA), Reading Rockets (RR), and the National Education Association (NEA) create and publish Facebook pages to promote their organizations and share useful resources for educators (Kabilan et al., 2010). These pages typically contain information on current trends and issues in secondary education, instructional resources, opportunities for professional development, and much more. In addition, they offer teachers the opportunity to collaborate with other secondary school teachers. Tracking educational organizations on Facebook is therefore "a way to access valuable information and resources for free and through an online medium that will likely be used anyway" (Pilgrim & Bledsoe, 2011). Teachers who follow education pages on Facebook receive several benefits. For example, they can receive effective instructional resources for free, build and maintain friendships and collegiate or professional relationships for mutual benefit, and receive valuable educational information such as magazine release notifications, teacher tips, and new books and e-books.

Facebook helps teachers create meaningful and dynamic educational experiences, particularly in language teaching, as it enables students to have meaningful and authentic conversations with native English speakers (Garrison and Kanuka, 2004). In this way, learners can improve their language skills,

increase their motivation and confidence in English and develop an intercultural understanding. According to Godwin-Jones (2008), "tools and platforms such as Facebook are useful for improving communication, human interaction, and language learning". In fact, Facebook can be a useful tool to attract students in a more casual and informal way of reading, writing and many other learning activities. Research shows that students also prefer Facebook for certain classroom activities such as sharing multimedia or text educational resources and interacting with other classmates in discussion and debate. Because of this, many teachers use this social network for educational purposes in various classrooms including English (Wenger, 1998).

2.5.2 Benefits of Facebook to Students

Facebook offers students many advantages. For example, it promotes human interaction and social exchange between participants (Mills, 2009), which "improves communication and language learning" (Godwin-Jones, 2008). In this way, Facebook can help develop students' communication skills (Blattner & Fiori, 2009). In addition, several studies have shown that using Facebook in the classroom can help students improve their speaking, writing, and reading skills (Bosch, 2009; Madge et al., 2009; Naidu, 2005; Ophus & Abbitt, 2009). Thus, this network has a positive effect on the students, as it makes teaching and learning more practical, interactive and holistic. For example, Ducate and Lomicka (2008) conducted a study with several students from France and Germany. In their study, they found that using Facebook to encourage collaborative learning in the classroom improved student learning.

Facebook also offers students a meaningful learning experience that allows them

to practice their language skills in a more relaxed and informal manner (Grgurovic, 2010). This helps teachers make a connection between learning and real-world problems. In this way, students can use the skills learned in the classroom and apply them in real situations outside the classroom (Godwin-Jones, 2008). Manan et al. (2012) found that using Facebook to link theories and concepts learned in the classroom with real-world contexts is a great way to improve student understanding.

2.5.3 Challenges of Using Facebook in Teaching and Learning

If teachers do not try to learn more about the multiple uses of all these online tools like Facebook, it won't be possible to engage and motivate students because they are ahead of teachers in the use of technology (Fewkes & McCabe, 2012). However, this is not the only challenge that educators face. A second challenge is the distinction between entertainment and truly intellectual engagement. The nature of multimedia can captive students easily, but this visual engagement does not necessarily represent intellectual engagement. In fact, too much multimedia stimulation can interfere with the deeper cognitive processing that is critical to learning (American Psychological Association, 2009). That is why teachers need to make sure that the activities they plan to develop using Facebook really help students to learn.

Another challenge that teachers face is that the preferred language used by most students to interact on Facebook is "Spanglish" (the combination of Spanish and English), or any other combination of languages according to each country. Very few students actually use Standard English to interact with each other. Thus, the quality of English used in the online interactions is very poor (Manan et al., 2012). That is why, in order to control this situation, teachers have to recommend and remind students that they

have to revise their work before posting it on Facebook. It is also useful to require students to check their choice of words, spelling and sentence structures during their interactions on Facebook (Fewkes & McCabe, 2012).

On the other hand, there are also concerns that social networking “increases the likelihood of new risks to the self, such as the loss of privacy, bullying, harming contacts and more" (Livingston & Brake, 2010). According to Huffman (2013), uninformed students and teachers can put themselves at risk by sharing the most innocent piece of information. Once information is released into cyberspace, it becomes a part of a global network. Persistence and search ability of content, replication and manipulation of content create a framework in which underage children are at risk (Boyd & Ellison, 2007). Online bullying has gone global as well. That is why some schools prohibit the use of Facebook and internet on school. In this case the solution is professional development. Professional development is essential to training classroom teachers and students on both the benefits and risks associated with social networking (Huffman, 2013). Furthermore, collaboration and inclusion of all stakeholders is vital in order to develop appropriate activities and lessons, especially when Facebook will be used as an educational tool (Picciano, 2011).

2.6 The Use of WhatsApp in Instructional Delivery

The WhatsApp story is an archetypal success story. The app was created by Brian Anton and Jan Koom, both Yahoo employees (Lu & Churchill, 2014). Backed by an $8 million investment from Major Sequoia, one of Silicon Valley's hottest investor holdings, the duo launched WhatsApp in 2009 and is enjoying great success. WhatsApp allows users to exchange images, videos, and audio or text messages using their Internet

connection. WhatsApp has positioned itself as a superior alternative to SMS messaging, which can be very expensive when used in foreign countries due to roaming charges; WhatsApp, on the other hand, relies on the active Wi-Fi network. Although critics have claimed that WhatsApp success stems from teenage "sexting," ultimately the device took off because it was able to tap into users' desire to get off their phone plan (Baran (2010). Despite strong competition (e.g., iMessage, LINE, BBand Viber), WhatsApp remains firmly entrenched as the market leader in messaging applications.

The general advantages of using WhatsApp instant messaging in the blended mobile lecture course are: (i) it facilitates online collaboration and cooperation between students connected from their school or home in a blended mobile lecture course; (ii) it is a free and easy-to-use application; (iii) groups connected to WhatsApp instant messaging can easily share learning objects through comments, texting, and messages. The discussions are related to the course content taught 100% in class; (iv) it offers students the ability to create a class publication and thus publish their work in the group; (v) information and knowledge are easily constructed and shared through WhatsApp instant messaging (Preston, et al 2010).

2.6.1 Benefit of WhatsApp in Instructional Delivery

Research has found that the integration of WhatsApp into higher education has resulted in desired learning as well as social benefits. For example, Plana et al. (2013) studied the influence of WhatsApp use on students' reading skills in English as a foreign language with 95 participants at two universities in Catalonia over a 12-week period. Instructors used content from the Quantum LEAP online learning environment and Macmillan's One Stop English website to design 37 questions tailored to their study (12

multiple-choice questions, 12 fill-in-the-blank questions, 12 true/false questions, in addition to one open-ended question), while participants received three questions each week to answer via WhatsApp. According to a student satisfaction survey conducted at the end of the study, approximately 91% of students said that their participation in the project increased their motivation to read in English. They also felt a positive impact on their reading habits, resulting in more regularity and confidence.

Similarly, Amry (2014) examined the effect of WhatsApp on the outcomes and attitudes of 15 female students who studied one unit of a six-unit media literacy course through WhatsApp group versus another group of 15 students who studied the same unit through a face-to-face learning approach in the classroom (control group). The instructor provided and managed all learning activities in the WhatsApp group during the research period. The study revealed differences at the .05 alpha level in favour of the experimental group regarding outcomes and attitudes toward the learning approach. The experimental group performed better on the achievement test because the students believed that WhatsApp facilitated learning through knowledge sharing.

Bansal and Joshi (2014) studied the perceptions of 37 pre-service teachers-32 women and 5 men-about their use of WhatsApp after 40 days of communication between them and their instructor. The instructor provided messages regarding teaching practices, classroom management, participant inquiries or problems, and administrative updates. According to a student experience survey conducted at the end of the study, 56% of participants agreed that learning via WhatsApp was very interesting and provided educational benefits, 81%-82% said that their social interactivity with peers and instructor increased and that they learned more collaboratively, and 76% had favourable

attitudes toward WhatsApp as a learning tool.

The general benefits of using WhatsApp instant messaging in the blended mobile lecture course are: (a) WhatsApp instant messaging facilitates online collaboration and cooperation between students connected from school or home in a blended mobile lecture course; (b) WhatsApp is a free and easy-to-use application; (c) Groups connected to WhatsApp instant messaging can easily share learning objects through comments, texting, and messages. Discussions are related to the course content taught 100% in class; (d) WhatsApp offers students the ability to create a class publication and thus publish their work in the group; (e) Information and knowledge are easily built and shared through WhatsApp instant messaging.

2.7 Concept of Academic Performance

Academic performance in school is assessed in many ways. The measurement of academic performance as a symbol of school success dates back to the Victorian era (Bell, 2013). Teachers assessed learners in the form of letter or number grades and side notes to describe the student's level of understanding. Cuben (1984), finds that one way to discover how teachers taught over a period of time is to examine whether instruction was teacher-cantered or student activity-cantered or a mixture of both to varying degrees. Teacher-cantered instruction means that the teacher controls what is taught, when and under what conditions in the classroom. Academic performance refers to performance in an academic subject, symbolized by a score on a test or exam.

Epunnah (1999) defined performance as the result of student learning, which includes the knowledge, skills, and ideas acquired and retained during their studies in and out of the classroom. Academic performance is the result of students'

mental abilities in an educational context.

Performance as defined by Simpson and Weiner, (1989) is an observable or measurable behaviour of a person or animal in a particular situation. Adedeji (2008) stated that academic performance of students is very important as it seems to be the main criterion by which the effectiveness and success of any educational institution could be judged. Mbah (2002) noted that academic performance depends on several factors among which are teaching techniques, learning environment, and especially motivation to stimulate students' interest in learning and learners.

2.8 The Role of Motivation in Teaching Delivery

Motivation is generally considered to be the willingness to achieve goals and the process of maintaining that willingness. Motivation provides an important foundation for completing cognitive behaviour, such as planning, organizing, decision making, learning, and assessments (Pintrich & Schunk, 1996). Spence and Helmreich (1983) defined achievement as task-oriented behaviour. Individuals' performance is often compared to norms or others for evaluations. The different perspectives of researchers result in various definitions of achievement motivation. The original definition of achievement motivation is that of Atkinson (1964), who defines it as the comparison of performance with others and with certain standard activities.

Atkinson and Feather (1966) suggested that achievement motivation is a combination of two personality variables: the tendency to approach success and the tendency to avoid failure. Bigge and Hunt (1980) defined achievement motivation as the willingness to work diligently and with vitality, to move consistently toward goals, to

achieve dominance in challenging and difficult tasks, and to create a sense of accomplishment as a result. This definition is composed of three elements: the stimulation of personal abilities, constant efforts with dynamism and the achievement of a sense of satisfaction. Achievement motivation is the basis for a good life. People who are achievement-oriented generally enjoy life and have a sense of control over it. Being motivated keeps people energized and gives them self-respect. They set moderately difficult but easily achievable goals that help them reach their goals. They do not set extremely difficult or extremely easy goals. In doing so, they ensure that they only undertake tasks that they can accomplish. Achievement-oriented people prefer to work on a problem rather than leave the outcome to chance. We also find that achievement-oriented people seem to be more concerned with their personal accomplishment than with the rewards of success.

2.8.1 Technology Integration and Knowledge

Motivation Cox (1997) studied elementary and secondary school students' use of technology and their attitudes toward ICT. The study was based on a review of the literature on motivation, as it indicates that regular use of ICT for a variety of subjects can have a stimulating and beneficial effect on student learning. The students' responses showed their increasing engagement in the learning task, reinforcing the enjoyment, benefit, and sense of success in learning when using ICT, and emphasizing their self-esteem. More than 75% of high school students responded "I agree" or "I strongly agree" to the statement that using computers makes school subjects more interesting. In addition, more than 50% of students reported that using ICT helped them understand their subjects better (Cox, 1997). Bullock (2001) conducted a case study on the effect

of ICT use on students' motivation and achievement in English. The results showed a great improvement in the motivation of the vast majority of students. In particular, students were more enthusiastic about starting the tasks, and this zeal was maintained throughout the task. Questionnaire responses from 88% of the class showed that using a diverse set of ICTs during this year made English classes more exciting and interesting than expected. In addition, 86% of the group noted that ICT helped them produce good work that allowed them to explore ideas and work creatively (Bullock, 2001).

Denning's (1997) research involved nine secondary schools located in West Sussex, Sheffield and Birmingham to study what and how ICT activities can stimulate students through positive experiences that involve the use of technology in a group of activities. 80% of teachers who regularly used ICT found that students were positively stimulated. Based on this research, we find that ICT has a positive effect on student motivation, and that the use of ICT enhances students' motivation to learn and leads to better performance on learning outcomes.

Learning in the ICT environment leads to more excitement and enjoyment of lessons, more pleasure in the learning experience, more control over their own learning process, more self-confidence and more self-esteem. In a controlled study by the International Association for Educational Achievement (IEA) focusing on six schools in England: three primary and three secondary, during the 2000/2001 academic year. The research revealed a number of positive effects on the students who participated, including improved motivation, increased self-confidence and self-esteem, enhanced social skills, improved cooperative and group work skills, and improved achievement (Harris & Kington, 2002).The climate project, undertaken by 48

junior high school students, was evaluated with the use of a laptop computer to collect temperatures and graph them in a geographic research centre.

Motivation and confidence in using the technology increased over three weeks and (Hennessy, 2000). This research investigated the magnitude of the effect of different uses of ICT during class on students' motivation to continue working at other times during the school day and outside of school. Teachers who allowed more participation in computer activities offered more computer use outside of class. Students' increasing use of computers in their free time is not related to socioeconomic status and ability (Becker, 2000).

In 2004, Passey and Rogers, along with Machell and McHugh, commissioned a study to examine the motivational effect of ICT on students and to assess the impact of ICT on students' interest in and attitude towards school work. The study aims to identify good practical examples of how ICT effectively improves student motivation (Passey et.al 2004), and involved quantitative data collected during the 2003 school year. The main methods used for data collection were interviews, observations and questionnaires. The impact on student motivation was obtained from the questionnaires and the analysis identified some key findings from this study. These results show that students' use of ICT resulted in positive motivational outcomes, and that these were most often found when ICT was used to support engagement. Passey et.al (2004) reported that ethnicity appeared to be unbiased to motivation, but that socioeconomic background had an impact in terms of limited access to ICT tools, including computers, either at home or at school. The teachers' report in this study indicated that they perceived a positive impact on students' interests and attitudes towards school work when ICT is used in the classroom.

Frydrychova and Poulova (2014) published an article on two studies conducted on ICT as a motivational tool in foreign language learning. This article focuses on EFL and the role of ICT on student motivation. Frydrychova and Poulovan (2014) explain that teachers need to "make learning stimulating and enjoyable by breaking the monotony of classroom events", and "increase the attractiveness of tasks", but also "administer tasks in a motivating way" and "increase students' motivation by promoting cooperation among learners" (Frydrychova & Poulova 2014). Frydrychova and Poulova (2014) further explain that these conditions can be achieved by integrating ICT into the classroom and that the results of this integration can therefore lead to more independent and personalized, but also more collaborative and interactive learning. Teaching can also become more varied, dynamic and relevant to the immediate needs of students. In Frydrychova and Poulova's (2014) study, they explain that all but one of the teachers can see that their students enjoy working with ICT tools in the classroom, as they can see the following benefits of ICT integration. The students are more active and think that the lessons are more interesting and they also think that the lessons are more varied in teaching and they are more motivated.

Bullock's (2001) study evaluates the impact of ICT use on students' motivation and achievement in English. He explains that students are more enthusiastic about working in groups and that the teachers surveyed saw an improvement in student motivation. The main findings of Bullock's (2001) study are that the integration of ICT in teaching leads to group work, but also allows students to work more independently, which increases students' enjoyment of the tasks presented. In addition,

Bullock noted an improvement in motivation among some male students who "are often a bit reluctant" to write in English.

Increased commitment to learning: Teachers who provide more engaging technology-based lessons report that students are motivated to continue using computers at other times of the school day and outside of school (Becker 2000; Rockman 2000). Students participating in Challenge 2000, an Internet-based resource, were eager to work during their free time, before and after school, as well as during scheduled sessions, and had no problem maintaining their motivation and enthusiasm (Harris & Kington 2002).

Improved sense of achievement: The use of ICT can enhance the sense of achievement of many students who were previously underachieving. Learning gains and increased motivation have been found in reading, writing and mathematics (Moseley & Higgins 1999), geography and English (Hennessy 2000; Van Daal & Reitsma 2000), and for students with special needs, in terms of producing higher quality work (Harris & Kington 2002). However, as with any task that does not include ICT, if the experience is too difficult or too easy, it can be demotivating (Cox 1997).

Support for self-directed study: students using an online GNVQ course have developed increased independence and motivation for an independent learning style that is considered valuable preparation for lifelong learning (Harris and Kington 2002).

Increased self-esteem; Notschool.net is a virtual community that gives youth the opportunity to develop self-esteem and be reintroduced to learning. This online research project examined ways to re-engage 92 disaffected youth ages 14-16 in an environment in which they could develop new ways of learning. Learning through an online

community was a key element in encouraging these students to re-engage in learning (Duckworth 2001).

Behaviour Improvement: The use of digital video has been shown to improve the behaviour of students with Attention Deficit Hyperactivity Disorder (ADHD). Numerous case studies show a range of positive effects on students, including an increased ability to work independently, increased confidence in communicating with people outside their school and family circle, improved school attendance and improved group work and cooperative skills (Harris and Kington 2002).

2.9 The Secondary school Chemistry Curriculum

The program to meet the chemistry requirements of the National Education Policy originally prepared by the Centre for Comparative Education Studies and Adaptation (CESAC) in December 1984 and reiterated by the Federal Department of Education (2007) has the objectives for upper secondary school chemistry as follows:

i. To facilitate a transition in the use of scientific concepts and techniques acquired in the sciences integrated with chemistry.

ii. Provide students with a basic knowledge of chemical concepts and principles through effective selection of content and sequencing ;

iii. Show chemistry in its relationship to other subjects ;

iv. Show chemistry and its relationship to industry, daily life, benefits and hazards

v. To provide a comprehensive course for students not pursuing graduate studies while providing a reasonably adequate foundation for a post-secondary chemistry course.

In addition to the above objectives, the goals of the WAEC chemistry program are: to enable students to appreciate the scientific method which involves experimentation, accurate observation, recording, inference, and interpretation of scientific data; to enable students to develop laboratory skills, including an awareness of hazards in the laboratory and the safety measures required to avoid them (WAEC, 1998, 2004). To achieve the above objectives, the content of the upper secondary chemistry curriculum is organized around the major concepts of energy, periodicity, and structure, while the fundamental principles of chemistry covered by the curriculum include: the particulate nature of matter, periodicity, and chemical combination, quantitative aspects of chemical reaction, rate of reaction, equilibrium, carbon chemistry, and industrial applications of chemistry.

The chemistry program is divided into three sections, corresponding to the three years of upper secondary education. The content of the program for the first year of high school (SS1) includes seven units. These are separation techniques, the particulate nature of matter, chemical combination, the gas state and laws, acids, bases and salts, carbon and its compounds, and industrial chemistry. The content of the Secondary 2 (SS2) program consists of five units. These are the particulate nature of matter (periodicity); quantitative aspects of chemical reactions; rates, energy, and equilibrium; non-metals and their compounds; carbon and its compounds (organic chemistry1). The SS3 course content consists of four units: wave/particle nature of matter, metals and compounds, carbon and its compounds (organic chemistry II), and space and earth chemistry. Thus,

the program is carefully structured to meet the objectives of chemistry education. The program recommends the use of a guided discovery approach to instruction. It also recommends the following assessment instruments: multiple choice questions, structured short answer questions, essay questions, and rating scales (where appropriate). The chemistry program is quite laudable (Anaekwe, 1997), but poor results and interest (Ifeakor, 2006; Njoku.2003, 2009) suggest poor implementation of the program. There is therefore a need to explore student-cantered cooperative learning and peer teaching to improve student performance in some difficult chemistry concepts

2.9.1 Problems of Chemistry Education in the Senior Secondary School

Iji, Adejo and Adikwu (2009) argue that many commendable facilities, programs and policies have been put in place to encourage and promote chemistry education in Nigeria, given its central place in human and national development.

However, the teaching of chemistry in the Nigerian secondary school system is plagued by many problems. Warra, Utono, Guru and Babayemi (2009) identified the main problems, namely;

i. Gross underfunding

ii. Lack of educational materials and equipment

iii. Lack of adequate laboratories

iv. Lack of trained teachers

v. Low motivation of staff and students,

vi. Lack of adequate programs to meet needs, interests and capacities students

vii. Lack of clear understanding of the goals of chemistry education

viii. Abuse and mismanagement of resources for teaching chemistry.

Aniebenomo (1999) deplores the abysmal failure rate in the 1998 SSCE in core subjects, including chemistry. The author attributes this, among other factors, to the shortage of teachers: there was a shortage of 17,581 chemistry teachers. The teaching of chemistry in secondary schools in Nigeria currently leaves much to be desired. The implementation of the curriculum is severely compromised by a multitude of factors. The nature of chemistry and the method of teaching are perhaps the most unfavourable factors in the implementation of the chemistry curriculum (Nzewi, 2010). Most chemical concepts are abstract and difficult for students to understand (Tajuden, 2005). These concepts have made the expository teaching method ineffective (Ezeliora, 2003). Therefore, it would be necessary to explore the effectiveness of student-cantered cooperative learning and peer teaching on student performance in some difficult chemistry concepts.

2.9.2 Student Performance in Senior Secondary Chemistry

Academic performance is the level of achievement of predetermined learning objectives by the learner. It is mainly reflected in the results of internal school examinations or external examinations such as the Senior School Certificate Examination (SSCE). The poor academic performance in upper secondary chemistry education is alarming and worrisome. Reports from WAEC researchers and chief examiners show a steady decline and poor performance of candidates for more than three decades in upper secondary school chemistry. The general comment in the WAEC Chief Examiner's report, Nov/Dec 2003, indicates that candidates' performance in chemistry was lower than in previous years and showed no significant improvement.

Mbanugo (2007) reports a continuous downward trend in the performance of chemistry students between 1988 and 1990 in the Senior School

Certificate Examination (SSCE) and the General Certificate in Education. Ifeakor (2006) shows the low performance of students in SSCE from May/June 1994 to 2004 and attributes it to students' fear that chemistry is difficult to learn, lack of skills and competencies to teach chemistry and shortage of qualified teachers. Ifeakor (2006) observed that the enrolment and performance of chemistry students at SSCE 1994 to 2004 is below average. According to Njoku (2009), the performance trend of chemistry students was poor from 2005 to 2008. Warra, Utono, Gunu and Babayemi believe that there is an urgent need to improve the poor performance in both internal and external chemistry examinations. Even in the internal exams, the performance in chemistry can be as low as 22.2% pass rate. Therefore, there is an urgent need to do something about the poor performance of chemistry students, hence the need for this research work.

2.10 Theoretical Framework of the Study

This section presents the theories behind this research work. Each of the variables involved in this research work is supported by different theories, as shown in Figure 2.3.1.

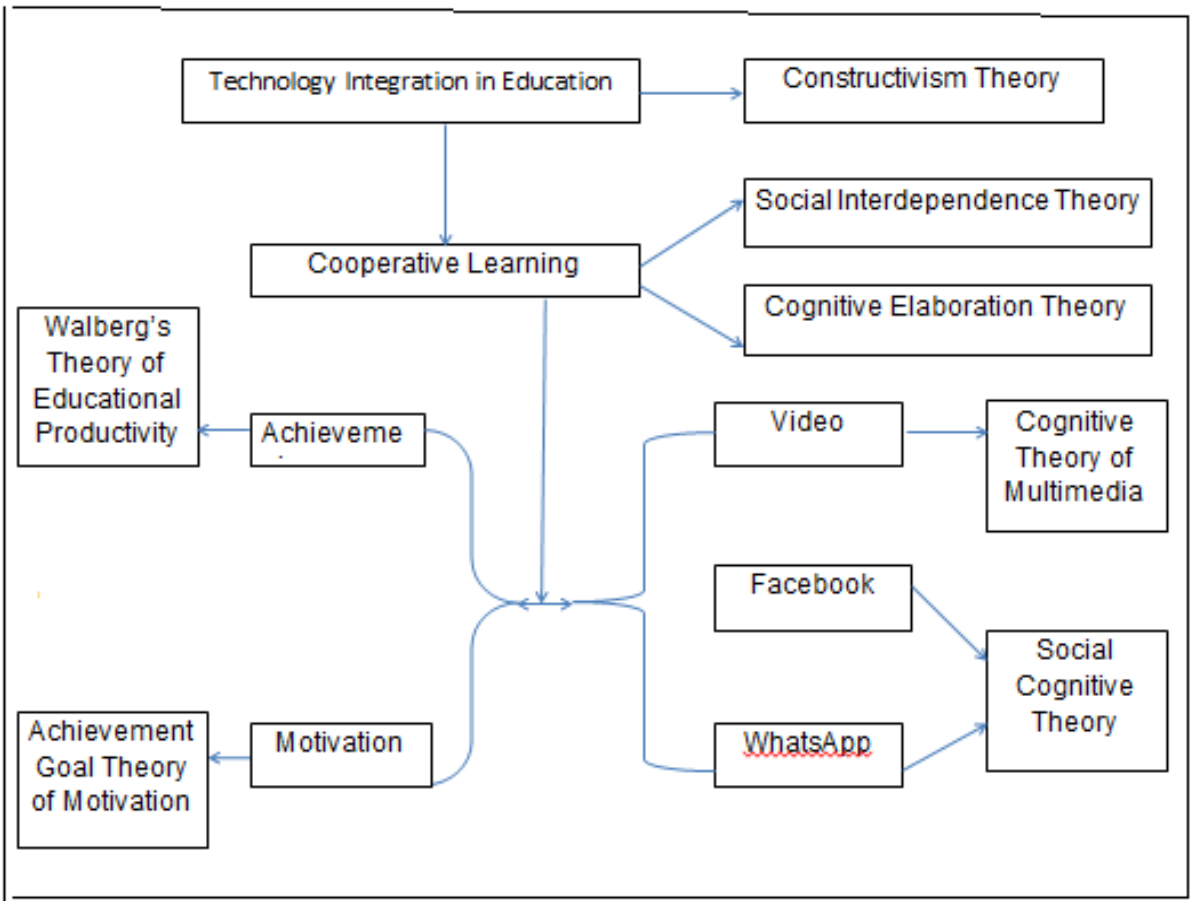

Figure.2.2: Theoretical Framework

2.10.1 Constructivism Theory

Constructivism is a psychological theory of knowledge that holds that humans construct knowledge and meaning from their experiences. Constructivist theory states that students are given tools to construct their own knowledge. Constructivism is a set of beliefs about knowledge that assumes that reality exists but cannot be known as a set of truths. Constructivism is not about accepting what you are told, but your prior knowledge about what you are taught and your perceptions about it. Constructivism emphasizes the active participation of students, so that the knowledge gained stays with them for a long time. Constructivism is not a new concept. It has its roots in philosophy and has been applied to sociology and anthropology, as well as cognitive psychology and education.

The first constructivist philosopher, GiambatistaVico, may have commented in a treatise in 1710 that "one knows something only if one can explain it" (Yager, 1991). Immanuel Kant expanded on this idea by stating that human beings are not passive receivers of information. Learners actively appropriate knowledge, connect it to previously assimilated knowledge, and make it their own by constructing their own interpretation.

Five fundamental themes permeate the diversity of theories expressing constructivism. These themes are: (1) active agency, (2) order, (3) the self, (4) the social-symbolic relationship, and (5) lifelong development.

Constructivists have proposed, first, that human experience involves ongoing active agency. This distinguishes constructivism from forms of determinism that make humans passive pawns in the game of larger forces. Second, they argue that much of human activity is devoted to a process of ordering - the organizational structuring of experience through tacit and emotional processes of meaning-making. Finally, constructivists argue that the organization of personal activity is fundamentally self-referential or recursive. This makes the body a fulcrum of experience and honours a deep phenomenological sense of personal identity. But the self is not an isolated island of Cartesianization. Persons exist and develop in living networks of relationships.

The fourth theme common to constructivism is that individuals cannot be understood apart from their organic integration into social and symbolic systems. Finally, all of this active, meaningful, and socially integrated self-organization reflects a continuous flow of development in which dynamic dialectical tensions are essential. Order and disorder coexist in a perpetual quest for a dynamic balance that is never quite achieved. The existential tone here is unequivocal. Together,

these five themes convey a constructive view of the human experience, emphasizing the meaningful action of a developing individual in complex and evolving relationships. Focusing on a more pedagogical description of constructivism, the meanings are intimately connected to experience. In constructivism, students come to class with their own experiences and a cognitive structure based on those experiences. These preconceived structures are valid, invalid or incomplete. The learner will reformulate his or her existing structures only if the new information or experiences are related to knowledge already in memory. The role of the teacher in constructivist theory is to organize information around conceptual clusters of problems, questions, and discordant situations to engage the student. Teacher's help students develop new ideas and connect them to their prior learning. Ideas are presented holistically as general concepts and then broken down into parts (Adams, 2006). Activities are student-cantered and students are encouraged to ask their own questions, conduct their own experiments, make their own analogies, and reach their own conclusions.

Cognitive theorists believe that the role of the teacher is to provide learners with opportunities and incentives to learn, arguing among other things that: (a) All learning, with the exception of simple role memorization, requires learners to actively construct meaning, (b) Students' prior understandings and thoughts about a topic or concept prior to instruction exert a tremendous influence on what they learn during instruction, (c) The teacher's primary goal is to generate a change in the learner's cognitive structure or way of seeing and organizing the world, and, (d) Cooperative learning with others is an important source of motivation, support, modelling, and coaching (Feden, 1995).

Constructivist learning requires that educators embrace the idea that each learner constructs, obtains, and interprets his or her own knowledge in different ways. Constructivism is an active process that allows students to make sense of their world (Adams, 2006). When it comes to integrating technology into the classroom, constructivism has not always been the basic theory. Previously, the philosophy of technology education followed the idea of instructivism. The instructivists argued that using an instructional system design model could be useful in identifying what is to be taught, determining how it will be taught, and evaluating the instruction to determine if it is effective. While this may be effective in terms of evaluation, the constructivist view has also developed and is now being considered when integrating technology education. Constructivists consider three main questions when it comes to any type of instruction: (1) What does it mean to know something? (2) How do we come to know it? (3) How does this knowledge influence our thought processes? Constructivists argue that the "systematic" process proposed by pedagogues is a problem; there is nothing systematic about how we learn or construct knowledge. Constructivists believe that knowledge is constructed socially, using language, and that everyone has different social experiences, resulting in multiple realities (Kanuka & Anderson, 1999). This point is important in maintaining a constructivist classroom while integrating technology. Educators must understand that learners will need a variety of different experiences. In addition, activities must be incorporated for learners to experience real-world relevance while using technology. One of the benefits of using technology for instruction in today's world is that communication technology has helped to maintain constructivist principles; constructivists view

technology as a powerful learning tool.

While educators remain true to their learning theory beliefs and design their classrooms around these theories, it is important to note that technology is no longer a pedagogical choice, but a necessity in today's classrooms. The success of technology-mediated learning activities to facilitate higher-order thinking skills will depend on the approach taken to the design, delivery, selection, and use of appropriate and effective technologies with a support structure to maintain and sustain learning transactions (Semple, 2000). Once technology is selected for a particular constructivist classroom, and teachers are willing to learn and commit to its implementation, designers can begin their process. Most educators accept the constructivist view that learners approach tasks with prior knowledge and expectations based on their knowledge of the real world. Therefore, constructivist educational technologists have been guided to create "authentic" environments for learning, environments that correspond to the real world. In applying constructivist theory, educational technologists should contextualize learning and "pre-authenticate" or create learning materials and environments that correspond to real world situations prior to learner interaction (Petraglia, 1998). The guiding principle of many technologists concludes that "instruction should take place in rich contexts that reflect the real world and that are as closely related as possible to the contexts in which that knowledge would later be used" (Dunn, 1994).

2.10.2 Social interdependence theory

Social interdependence theory is relevant when each individual's goals are achieved through the influence of others' actions (Johnson & Johnson, 2005). According to this perspective, students help each other learn because they care about the group and

its members and benefit in terms of personal identity (Slavin, 2011). A strong relationship has been found between cooperative learning and social interdependence theory (Johnson &Johnson, 2005). Levin (1948) proposed that states of tension motivate a person's behaviour and when desired goals are perceived, actions are motivated by this tension to achieve desired goals. Deutsch (1949) expanded on Levin's theory of social interdependence by discussing the relationship between the goals of two or more individuals. According to Deutsch (1949), social interdependence can be both positive and negative. It can be positive when individuals work cooperatively to achieve their common goals, and it can be negative when individuals compete to claim the achievement of goals. Each type of interdependence involves certain psychological processes. In cooperative situations, as Deutsch (1949) argued, psychological processes are associated with substitutability (the degree to which one person's actions replace another's actions), inducibility (openness to being influenced and influencing others), and positive cathexis (the investment of psychological energy in objects outside of oneself, such as friends, family, and work) (Johnson & Johnson, 2005). In competitive situations, the opposite psychological processes are highlighted, namely non-substitutability, negative cathexis, and resistance to the influence of others.

A lack of social interdependence detaches an individual from others, creating non-substitutability, cathexis only to one's own actions, and a lack of inducibility, or resistance to fully shared goals. The basic premise of social interdependence theory is that the way goals are structured determines how individuals interact, and patterns of interaction create outcomes (Deutsch, 1949). Positive interdependence can result in promotive interaction, negative interdependence can result

in oppositional interaction, and no interdependence can result in no interaction (Johnson & Johnson, 2008). Promotive interaction occurs when individuals encourage and facilitate each other's efforts to complete tasks and achieve group goals. It includes variables such as mutual aid and assistance, exchange of needed resources, effective communication, mutual influence, trust, and constructive conflict management.

Oppositional interaction occurs when individuals discourage and obstruct each other's efforts to accomplish tasks and achieve their goals. It includes variables such as obstructing the other's efforts to achieve their goals, threatening and coercive tactics, ineffective and misleading communication, distrust, and a desire to win conflicts. Lack of interaction occurs when individuals act independently, without any exchange with each other, as they strive to achieve their goals; individuals focus solely on increasing their own productivity and achievement and ignore the efforts of others as irrelevant.

The benefits of social interdependence are identified as effortful, positive relationships and social support, psychological health, and self-esteem (Johnson & Johnson, 2009). For example, in a meta-analysis of 575 experimental studies conducted at different educational levels, in different domains, and in many countries, Johnson & Johnson (1989) found that cooperation promotes significantly higher performance than competitive or individualistic efforts. In cooperative situations, performance was constructed in terms of achievement and productivity, long-term retention, on-task behaviour, use of higher-level reasoning strategies, generation of new ideas and solutions, transfer of what is learned in one situation to another, intrinsic motivation, achievement motivation, continued motivation to learn, and positive attitudes toward learning and

school (Johnson & Johnson, 2008).

Similarly, in a review of 158 studies, Johnson & Johnson (2002) found that cooperative learning conditions lead to greater success than competitive or individualistic conditions. In addition to success, positive relationships between individuals are more strongly encouraged by cooperation than by competitive or individualistic efforts (Johnson & Johnson, 2002).

Positive relationships in cooperative situations include interpersonal attraction, sympathy, cohesion, esprit de corps, and social support (Johnson & Johnson, 2008). Additionally, a strong relationship has been found between cooperation and psychological health (Johnson & Johnson, 1989; 2002). Psychological health refers to the ability (cognitive abilities, motivational orientations, and social skills) in which cooperative relationships between individuals are developed and maintained to successfully achieve goals (Montagu, 1966; Horney, 1937). Social interdependence theory provides a basis for the practice of cooperative learning. This theory is consistent with the nature of cooperative learning in which knowledge and skills are constructed through mutual interaction among participants. Therefore, in the process of implementing cooperative learning, interactive tasks and cooperative lessons must be designed and implemented in classrooms to help students work and learn together to achieve common goals.

2.10.3 Cognitive Elaboration Theory

Another cognitive perspective relevant to an exploration of the value of cooperative group work, based on the notion of cognitive elaboration (explaining something more), has been identified by O'Donnell & O'Kelly (1994) and O'Donnell

(2000). This view emphasizes the effectiveness of elaboration in the learning and thinking process, and that elaboration prepares the individual for cognitive restructuring and rehearsal to improve learning tasks (Slavin, 2011).

Research in cognitive psychology has long argued that if information is to be retained in memory and linked to information already in memory, the learner must engage in some sort of cognitive restructuring, or elaboration of material (Wittrock, 1986). Another explanation might be that an effective elaboration technique is required in almost all cooperative learning methods (Slavin, 2011). Elaboration involves adding new information to existing knowledge and restoring it, which allows for deeper processing of the lesson content (Singhanayok & Hooper, 1998; Iqbal, 2004). If students have the opportunity to explain or clarify ideas, their learning will be more successful (Zakaria, Chin & Daud, 2010).

Elaboration not only improves students' learning when offered explanations, but also expands their understanding when they give elaborate explanations to others (McKeachie, 1999). In addition, an important benefit of receiving information from others is that it provides students with more opportunities to access information and observe the learning strategies used by other students (Singhanayok & Hooper, 1998). Research on peer tutoring has revealed benefits for both the tutor and the mentee. In these methods, students play the role of reminder or listener. They read a portion of the text, then the reciter summarizes the information while the listener corrects errors, completes omitted material, and helps find ways for both students to remember the main ideas (Slavin, 2011). In a review of 19 studies of small group oral interaction, Webb (1989) reports that "the effectiveness of group learning

depends on the level of elaboration of explanation, since the processes of mutual explanation and questioning are considered effective means of elaboration." He also found that students gain more knowledge and skills by engaging in cooperative activities when they offer more explanation to others. O'Donnell (1996) found that students who work on structured cooperative scenarios can learn material or procedures better than students who work alone. While both the reminder and listener learned more than students working alone, the reminder learned more (O'Donnell & Dansereau, 1992). This finding reflects both the results of peer tutoring and Webb (2008), who found that students who benefited most from cooperative activities were those who provided elaborate explanations to others.

Studies of reciprocal teaching, in which students learn to formulate questions for each other, have generally supported its positive effects on student achievement and retention (O'Donnell, 2000; Rosenshine & Meister, 1994). This perspective implies the nature and principles of cooperative learning in which learners work and learn from each other through reciprocal interactions and explanations. Therefore, students in cooperative learning groups are expected to cooperate with other students in their group on assigned learning material, discuss the material, complete their own assigned section of learning material, and then teach others in their group their portion of the material. Through all of these activities, students are expected to gain knowledge in an effective manner.

2.10.4 Cognitive Theory of Multimedia Learning (CTML)

The basic premise of CTML is: How does multimedia learning work? How does the learner make sense of the instructional material and construct meaningful connections and new knowledge (Sorden, 2012)? Richard E. Mayer is the cognitive scientist who

developed this theory and has spent nearly thirty years researching and updating it as educational multimedia has evolved. Mayer built this multimedia model from the work of Palvio, Baddelev and Sweller. His multimedia model and design principles were created after conducting numerous experiments with students in the psychology subject group at the University of California at Santa Barbara (Reed, 2006). In his multimedia instruction experiments, he tested different types of cognitive constraints on multimedia learning. Learners were divided into different groups during the experiment. Upon completion of the multimedia piece(s), learners were asked to answer questions that measured retention of what had been learned.

The framework for multimedia learning and mind function is rooted in these three assumptions: dual channel, limited capacity, and active processing. These three assumptions, and how they are activated in this model, are explained below:

Dual channels: According to Austin (2009), "the dual channel processing hypothesis is based on Paivio's seminal work. Learners have different channels in their brain to process visual and verbal material separately (Mayer & Moreno, 2003). The learner will select relevant words to process in verbal working memory and relevant images to process in visual working memory (Toh, Munassar, & Yahaya. 2010).

Limited capacity: there is a limit to the amount of information (verbal and visual) that each channel can process.

Active processing: for meaningful and deep learning to occur, it depends on the learner's cognitive processing to be able to select, organize, and integrate the information (verbal and visual) presented with their prior knowledge (Mayer, 2008).

Spatial Contiguity Principle - Multimedia pieces are best designed for the learner when words and pictures are placed close together rather than at a distance from each other (Sorden, 2012).

Temporal Contiguity Principle - Learners respond better to instructional multimedia pieces that present words and graphics continuously rather than one after another (Sodern, 2012).

Consistency principle - Learners are more successful in grasping the concepts in the educational multimedia piece when irrelevant elements are not included. The multimedia piece should not contain different concepts on the same frame or slide. The designer should also not include multiple images in the same frame or slide, as this can visually overload the learner.

Modality Principle - Graphics and narration are more effective in educational multimedia pieces than text and graphics on a page.

Redundancy Principle - Graphics, narration, and printed text should not all be implemented on a slide or frame. Instead, only graphics and narration should be presented. The designer should not include interactive animations if video is used, as they can compete and distract the learner.

Individual Differences Principle (also known as the personalization principle) - Formal style conversations should not be used. Instead, the instructor should speak in a conversational style (Sorden, 2012).

Signaling Principle - Learners are able to recognize and learn information more easily when callouts, arrows, and highlighting are used for key aspects.

Segmentation Principle - Learners understand the instructional multimedia piece better when the lesson is broken down into self-paced chunks rather than a single multimedia piece (Sorden, 2012).

Pre-training Principle - Instructional multimedia is most effective when learners have received prior training on the objectives and key concepts they will learn.

Voice Principle - Learners are more engaged in the learning process when the voice in a multimedia presentation is human rather than computer-generated.

Image Principle - The image of the instructor on the screen does not generate more meaningful learning than if the image were not present.

Cognitive scientists have identified three major challenges that multimedia designers face when creating educational multimedia over the past decade: extraneous content, extraneous detail, and complexity (Ibrahim, 2012). Educational multimedia pieces that contain extraneous content can overload learners' processing capacity. According to Ibrahim (2012), "empirical studies have shown that learners performed better on a problem-solving transfer test after reviewing a concise lesson, rather than an extended one."

Too much information (verbal and visual) in the instructional multimedia piece can reduce the learner's ability to focus on the main idea. Adding headers, highlighting key concepts, and using symbols can help the learner focus on the information they need to learn. If an instructional material is too detailed or too long, it can lead to cognitive overload for the learner and depends on the learner's prior knowledge. The more prior knowledge the learner has about a lesson or topic, the less mental effort is required. This gives the learner a greater cognitive capacity to select and organize new information

(Höffler & Leutner, 2007). To avoid cognitive overload, the lesson should be broken down into segments. If the visual and on-screen text are too far apart or appear at different times, it can create a split attention effect (Aostinho, Tindall-Ford, &Roodenrys, 2013).A multimedia designer must understand these three challenges before he or she can effectively develop a strong instructional multimedia piece.

Mayer has conducted extensive experimental research to determine which elements of instructional multimedia achieve the most meaningful learning. Her research found that contiguous narration and visual graphics in videos are extremely effective for beginning level courses, visual learners, and for introducing complex topics (Berk, 2009). Designers must understand that learners generate more meaningful learning when text is presented verbally rather than printed on the screen (Kalyuga, Chandler, &Sweller, 2000). An experiment conducted by Park, Flowerday, and Brünken (2015) found that learners learn better with a narrative rather than with the word printed next to a complex visual. Multimedia designers should place graphics and text in close proximity to each other. In addition, graphics that are decorative or do not contribute to the main objectives of the lesson should not be used.

Mayer's research has shown that when learners have control over the pace of multimedia, learning is more meaningful and effective (Oud, 2009). Mayer and Chandler conducted several experiments where learners had control over their instructional multimedia piece. Some experiments were very basic, with the learner having control of a pause button. In an experiment conducted by Sage, Bonacorsi, Izzo, & Quirk (2015), only a quarter of the learners used the "click to pause" feature. Although only a quarter of learners used this feature, the majority of learners reported that they were happy that it

existed. Another experiment compared the learner-controlled to the system-controlled version. Their results concluded that the learner-controlled version had better transfer performance than the system-controlled version (Tabbers & De Koeijer, 2010).

2.10.5 Social Cognitive Theory

In social cognitive theory, the learner is seen as fully integrated with the environment in which he or she learns. The learner's cognitive responses, behaviours and environment all work together to create learning. Learners observe patterns and develop self-efficacy, that is, their belief that they can do the modeled work. If the learner understands why it is important to learn something and is convinced that they can do it, they will self-regulate their learning and become proactive in their efforts to master it. Bandura pioneered this set of theories and this fundamental concept of the learner embedded in the social environment.

Bandura wrote that individuals possess a self-system that allows them to exercise some control over their thoughts, feelings, and actions (Pajares 1996; Bandura1986). This self-system houses the individual's cognitive and affective structures and includes the abilities to symbolize, learn from others, plan alternative strategies, regulate one's own behaviour and engage in self-reflection. It also plays an important role in providing reference mechanisms and a set of sub-functions for perceiving, regulating, and evaluating behaviour, which results from the interaction between the self-system and external environmental sources of influence. As such, the self-system performs a self-regulatory function by giving individuals the ability to modify their environment and influence their own actions.

Because of the influential role that mass media play in society,

understanding the psychosocial mechanisms by which symbolic communication influences human thought, affect, and action is of considerable importance. Social cognitive theory provides a conceptual framework for examining the determinants and mechanisms of these effects. Human behaviour has often been explained in terms of unidirectional causality, in which behaviour is shaped and controlled either by environmental influences or by internal dispositions. Social cognitive theory explains psychosocial functioning in terms of reciprocal triadic causation (Bandura, 1986). In this transactional view of the self and society, personal factors in the form of cognitive, affective, and biological events, behavioural patterns, and environmental events all function as interactive determinants that influence each other in a bidirectional manner.

Social cognitive theory is based on an agentic perspective (Bandura, 1986, 2001). People are self-organizing, proactive, self-reflective, and self-regulating organisms, not just reactive organisms shaped and directed by environmental events or internal forces. Human self-development, adaptation, and change are embedded in social systems. Therefore, personal agency operates within a vast network of socio-structural influences. In these agentic transactions, people are both producers and products of social systems. Personal agency and social structure function as co-determinants in an integrated causal structure rather than as a disembodied duality.

Seen from a social-cognitive perspective, human nature is a vast potentiality that can be shaped by direct experience and observation into a variety of forms within biological boundaries. To say that one of the major distinguishing features of human nature is the plasticity with which it is endowed is not the same as saying that it has no nature or that it is without structure (Midgley, 1978). Plasticity,

which is intrinsic to the nature of humans, depends on neurophysiological mechanisms and structures that have evolved over time. These advanced neural systems, specialized in the processing, storage, and use of coded information, are the source of the very capacities that are distinctively human: generative symbolization, foresight, evaluative self-regulation, reflective self-awareness, and symbolic communication.

Social cognitive theory gives a central role to cognitive, vicarious, self-regulatory and self-reflective processes. An extraordinary capacity for symbolization provides humans with a powerful tool for understanding their environment and for creating and regulating the environmental events that affect virtually every aspect of their lives. Most external influences affect behaviour through cognitive processes rather than directly. Cognitive factors determine in part what environmental events will be observed, what meaning will be attached to them, whether they will leave lasting effects, what emotional impact and motivational power they will have, and how the information they carry will be organized for future use. It is with symbols that people process and transform transient experiences into cognitive patterns that serve as guides for judgment and action. Through symbols, people give meaning, form and continuity to their experiences. People understand cause and effect relationships and expand their knowledge by symbolically harnessing the wealth of information from their personal and vicarious experiences. They generate solutions to problems, evaluate their likely outcomes and choose appropriate options without having to go through laborious behavioural research. Through symbols, people can communicate with others at any distance in time and space. However, in keeping with the interactional perspective, social cognitive theory pays close attention to the social origins of thought and the

mechanisms by which social factors exert their influence on cognitive functioning. Other distinctive human capacities are based on this advanced capacity for symbolization.

2.10.6 Achievement Goal Theory

Achievement Goal Theory Motivational theories focus on the processes that explain goal-directed activity (Pintrich & Schunk 2002). In general, motivational theorists are interested in explaining physical activity, such as task engagement and persistence, as well as cognitive activities, such as problem solving and decision making. In educational research, theories of motivation are most often used to explain students' activity choice, engagement, persistence, help-seeking, and academic performance. Motivation is also used as a measure of academic adjustment (Roeser& Eccles 1998). Students who are alienated or disaffected generally lack motivation to attend school and engage in learning. Research on motivation has a long history, beginning with the philosophy of William James and extending to the achievement goal theories of the 1980s. Many of the early theories explain motivated behaviour in terms of drives, instincts, motives, and other internal traits (Weiner 1990). Motivation has also been explained in terms of behavioural associations involving reward contingencies (Pintrich & Schunk 2002). More contemporary theories focus on social-cognitive processes as sources of motivation. This view is represented in attribution theories of motivation, which associate achievement efforts with how individuals interpret their successes and failures in achievement situations (Weiner 1979). Another social-cognitive approach to motivation, expectancy-value theory, links achievement-related behaviour to individual expectancy and perceptions of value (Atkinson 1964; Eccles 1983; Wigfield & Eccles 1992, 2000). Individuals are more likely to engage in a

particular achievement task when they expect to do well and when the task has some value to them. Similarly, self-efficacy theories of achievement motivation emphasize the importance of individual judgments of ability (Bandura 1986, Schunk 1991).

Achievement goal theory is part of this social-cognitive view of motivation. Over the past 25 years, it has emerged as one of the most important theories of motivation (Pintrich 2000). It has also served as an important lens for analysing the influence of different classroom structures and school environments on student motivation and learning. Rather than focusing on perceptions of ability and causal attributions, goal motivation theories focus on the types of goals pursued by individuals in achievement situations. Goal theorists view behaviour as voluntary, intentional, and directed toward the achievement of certain goals (Pintrich & Schunk 2002). Achievement goal theorists focus specifically on goals involving the development or demonstration of skills (Maehr & Nicholls 1980, Nicholls 1984).

According to Nicholls (1984), "the distinguishing characteristic of achievement behaviour is its goal of competence or perceived competence," and competence can be defined in several different ways. Thus, the criteria or standards of excellence that people use to judge their competence are key to achievement goal theory. This is critical because classrooms and school environments differ in the assessment standards used to evaluate students' academic progress and achievement (Ames 1992; Ames &Archer 1988; Eccles & Midgley 1989; Nicholls 1989).

In recent years, researchers have distinguished between two types of performance goals. Performance approach goals focus on obtaining favourable judgments of

competence, whereas performance avoidance goals focus on avoiding unfavourable judgments of ability (Elliot & Church 1997, Elliot & Harackiewicz 1996). Similarly, Pintrich (2000) argued that mastery goals should be divided into mastery approach goals and mastery avoidance goals. When students focus on the mastery-approach variables, they want to learn, master, and truly understand the task at hand. In contrast, when they focus on mastery-avoidance goals, they want to avoid misunderstanding or not being able to learn from a specific task. To date, mastery approach and mastery avoidance goals have not been widely studied.

Over the past 25 years, achievement goal theories have emerged as an important framework for analysing the influence of learning environments on a range of developmental and learning outcomes. Much of this research indicates that youth take the most positive and appropriate approach to learning when the school environment emphasizes learning, understanding, and improving skills and knowledge. Although classroom environments focused on demonstrating ability and competing for grades may increase some students' self-efficacy beliefs and academic performance, evidence suggests that many youth are less motivated under these conditions. Students also report more disruptive behaviours (teasing, inappropriate language, etc.) as well as increased truancy and cheating in performance goal structures (Anderman and Midgley 2002, Kaplan et al. 2002, Roesern and Eccles 1998).

The results of these studies also highlight the important role of students' perceptions of their learning environment (Schunk & Meece 1992). We have known for some time that youth interpret and respond differently to their school experiences. To some extent, students' perceptions may resemble the reports of teachers

or observers. However, the "functional significance" of students' school experiences in the classroom is most prominent in studies of children's development in school settings (Ryan & Grolnick 1986). Therefore, it is important to examine the school environment from the perspective of the learners (McCombs 2003, Meece et al. 2003).

An intriguing anomaly in achievement goal research is the lack of strong relationships between mastery goals and student achievement. Students who are mastery-oriented report a desire to learn and improve their abilities, but this personal and classroom goal orientation is generally unrelated to measures of academic achievement, such as grades and test scores, when prior ability is controlled for (Anderman & Midgley, 1997; Elliot & Church, 1997; Elliot et al., 1999; Harackiewicz et al., 2000; Roeser et al., 1996; Skaalvik, 1997; Wolters, 2004). This missing link may be due in part to the way academic performance is measured. Most measures of achievement are not designed to assess a student's deep understanding of a concept or content area. Grant & Dweck (2003) reported that mastery goals show stronger positive relationships with performance measures when a high degree of challenge is present, when processing complex or difficult material is required, or when the learning task itself is personally valued. In addition, there is evidence suggesting that the influence of mastery goals on learning outcomes may be mediated by self-efficacy beliefs (Roeser et al. 1996) or deep processing strategies (Grant & Dweck 2003). Therefore, as originally designed, learning or mastery goals trigger a variety of affective or cognitive processes that have a more immediate impact on academic performance. The processes by which mastery goals affect academic performance need to be examined in more detail (Grant & Dweck 2003). In addition, most studies of classroom goal structures pay little

attention to the quality of instruction students receive (Meece et al. 2003). A mastery-focused goal is likely to have a greater impact on student outcomes, especially for students who lack prior knowledge and skills, when instructional practices facilitate mastery of concepts and content. Additional research is needed to examine the quality of instruction that students receive in mastery-based classrooms.

2.10.7 Walberg's Theory of Educational Productivity

Walberg's (1981) educational productivity theory proposed theoretical models to explain the relationships between learning variables and student academic outcomes (DiPerna, Volpe & Stephen, 2002). In their research, Walberg and his associates concluded that despite living in disadvantaged and risky environments, some children overcame and achieved high levels of achievement, motivation, and performance (Gutman, Sameroff & Eccles, 2002).

Walberg's theory of academic achievement posits that students' psychological characteristics and their immediate psychological environment influence academic outcomes (cognitive, behavioural, and attitudinal) (Reynolds & Walberg, 1992). In addition, Walberg's research identified key variables that influence academic outcomes as: student ability/previous success, motivation, age/developmental level, amount of instruction, quality of instruction, classroom climate, family environment, peer group, and media exposure outside of school (Walberg, Fraser, & Welch, 1986). Research on learning environments (Astin, 1993; Fraser, Walberg, Welch, & Hattie, 1987; Fullarton, 2002) shows that psychosocial characteristics of classroom learning environments demonstrate incremental validity in predicting student outcomes. These psychosocial characteristics (such as student self-concept, attitudes, behaviours, intrinsic

motivation, and overall engagement in learning) are useful in curriculum evaluation studies and can provide teachers with useful information for organizing more optimally functioning classrooms. Research has shown that school environments contribute to improvements in students' abilities, interests, and attitudes (Feldman, 1988; Feldman, Ethington, & Smart, 2001). Holland (1997) noted that environments promote skill development, motivate individuals to engage in different activities, and reward individuals for displaying values and attitudes. Thus, the environment influences personal and professional self-perceptions, skills, attitudes, interests, and values.

Holland (1997) further states that a college student's experiences include, but are not limited to: (a) the student's search for an academic environment that matches his or her types of skills, interests, and personality profiles; (b) the effects of academic environments on the student's social behaviour in an effort to acquire desired skills, interests, and values; and (c) the student's success which includes a function of personality type and academic environment. Haertel, Walberg, and Weinstein (1983) identified 8 major models of academic learning that are either based on psychological learning theory (Glaser, 1976) or time-based learning models (Bennett, 1978; Bloom, 1976). Despite the variation in construct names, Watson and Walberg (2002) found that most of the 8 theories included variables representing ability, motivation, quality of instruction, and quantity of instruction. Constructs less represented in the models were classroom social environment, family environment, peer influence, and mass media (Watson & Keith, 2002). The theory review, multiple quantitative syntheses of classroom research, and secondary data analyses of large-scale national surveys (Reynolds & Walberg, 1992), generally support

Walberg's overall model of educational productivity. Walberg's model specifies that:

> Classroom learning is a multiplicative, diminishing returns function of four essential factors: student ability and motivation, quality and quantity of instruction, and possibly four additional or supportive factors: the social and psychological environment of the classroom, the stimulating conditions of education at home and in the peer group, and media exposure. Each of the essential factors appears to be necessary but insufficient on its own for classroom learning; in other words, all four factors appear to be required at least at a minimum level. It also appears that the essential factors can substitute, offset, or trade off against each other with diminishing rates of return: for example, immense amounts of time may be required for moderate learning to occur if motivation, ability, or quality of instruction are minimal.

An important finding of the large-scale causal modelling research of Walberg et al. was that nine different factors of educational productivity were assumed to operate vis-à-vis a complex set of interactions to account for school learning. In addition, some student characteristic variables (motivation, prior achievement, attitudes) had indirect effects (e.g., Wang, Haertel, and Walberg (1993) organized the relevant knowledge base on school learning into broad construct domains (state and district governance and organization, family and community contexts, demographics, culture, school climate, policies and practices, curriculum and instructional design and delivery, classroom practices, learner characteristics) and attempted to establish the relative importance of 228 variables in predicting school domains. Using a variety of methods, the authors concluded that psychological, instructional, and home environment characteristics ("proximal" variables)

have a greater impact on outcomes than variables such as state, district, or school-level policies and demographics ("distal" variables). More importantly, in the context of this article, student characteristics (i.e., social, behavioural, motivational, affective, cognitive, metacognitive) were the set of proximal variables with the most significant impact on learner outcomes (DiPerna, Volpe & Stephen, 2002).

2.11 Review of Empirical Studies

2.11.1 Effect of Video Based instructional Strategy on Students Academic Performance

Abbey and Okorogba (2017) studied the comparative effect of students' academic performance in learning financial accounting using an instructional video. The research was a two-group post-test only randomized experimental research design. The population consisted of 20 male students and 12 female students. Mean and standard deviation were used to analyse the research question, while t-test analysis was used to analyse the research hypothesis. The results of the research reveal that students who were taught financial accounting using a conventional lecture method and instructional video performed better than students who were taught financial accounting using a conventional lecture method without an instructional video, with a mean difference of 13. The study recommends that teachers improve financial accounting instruction by introducing instructional video as an educational technology.

Gambari; Shittu; Daramola and James. (2016) conducted research on the effects of video-based cooperative, competitive, and individualized instructional strategies on upper secondary students' performance in geometry. A pre-test, post-test, experimental control group design was employed in this study. Purposive sampling technique was used to select four high schools based on certain criteria. 120

second year mathematics students were randomly selected from four mixed schools in Minna, Nigeria. Analysis of variance, Scheffe's post hoc test, and t-test were used to analyse the data. The results revealed that there was a significant difference in group performance in favour of the cooperative group. In addition, the gender of the students had no influence on the performance of the students in the cooperative and individualized groups. However, males performed better than females in the competitive teaching strategy. Based on these results, it was recommended that mathematics teachers use a video-based cooperative teaching strategy to improve students' performance in this subject. El-Sayed and El-Sayed. (2012) conducted research on video-based lectures: an emerging paradigm for teaching human anatomy and physiology to nursing students. A quasi-experimental research design was employed in the research work. Data were collected from 27 students in a baccalaureate nursing program and experimental control was achieved using an alternating treatment design. Fisher's exact test was used to compare quantitative data expressed as frequency and percentage, Pearson's correlation was used. The results revealed that video-based courses offered more success and reduced failure in immediate and follow-up measures compared to the traditional method of teaching human anatomy and physiology that was based on printed illustrations, but these differences were not statistically significant. In addition, nursing students appeared positive about their learning experiences, as they rated all items assessing their acceptance and satisfaction with the video courses highly.

Gambari and Olumorin (2013) investigated the effectiveness of the video-based cooperative learning strategy on high, medium, and low achieving students. A pre-test,

post-test, experimental control group design was used in this study. A total of 120 upper secondary mathematics students were randomly assigned to cooperative, competitive, individualized, and conventional instructional methods. Students in each group were stratified into three categories: high, average, and low achievers. Analysis of variance and Scheffe's test were used to analyse the data. The results indicate that there is a significant difference in group performance in favour of the cooperative learning strategy. Students' achievement levels had a significant influence on their performance in both the competitive and individualized instruction settings. It is recommended that mathematics teachers use cooperative learning strategies to improve student performance and bridge the gap between high, average, and low achievers.

2.11.2 Effect of Video Based instructional Strategy on Students Academic Motivation Ljubojevic; Vaskovic, Stankovic and Vaskovic (2014) conducted a study on the use of supplemental video in multimedia teaching as a teaching tool to increase the effectiveness of learning and the quality of the experience. The research was carried out at a university located in Bosnia and Herzegovina. The participants were 46 undergraduate students who took the same academic course. This research result has shown that segmenting educational material with additional video clips can improve the organization and presentation of lectures in order to achieve effective teaching and learning. The context of the video content and the position of additional video clips in the course material are important influences on the motivators and effectiveness of learning. Experimental results have shown that the most effective method of using supplemental video is integration with educational video content in the middle of a conference. This video insertion position offers the best results. The context of the video content also

influences the effectiveness of learning. Entertainment video was not as effective as instructional, but it can be used to engage and motivate students to learn.

Park and Jung (2016) explore the use of video clips for motivation building in a high school EFL setting. Fifteen Korean EFL students in the high school setting participated in an 8-week English program, which used video clips that included TED talk rehearsals, sitcoms, TV reports, and movies like main study material. The results of the pre- and post-surveys were compared using a t-test. The results of motivation surveys and student interviews showed that after taking the course, students became more motivated, especially in terms of gaining a positive attitude towards the English language and culture, and activities. Group competitions that followed viewing of video material influenced student participation. The implications for EFL classes with low student motivation are discussed. Ma'rifah, (2013) studied the use of interactive video to improve students' motivation to learn English.

Research results have shown that interactive videos play an important role in increasing student motivation. It is not only the teacher who plays this type of video and then the students watch it, but there is such type of video that can elicit student interaction and some steps to implement it. They further stated that using interactive video can improve students' motivation to learn English, but this method requires equipment that most schools do not have.

2.11.3 Effect of Facebook Based instructional Strategy on Students Academic Achievement

Alias; Siraj; Daud; Hussin, (2013) examine the effectiveness of Facebook-based learning in enhancing the creativity of Islamic studies students using the isman

instructional design model. The Turkish Online Journal of Educational Technology volume 12 Number 1. A quantitative study was carried out using an experimental method and a background investigation. The instruments used were a questionnaire and a creativity test form for measuring student creativity. The treatment group consists of 40 participants randomly selected from among the students, while the control group of 40 participants was drawn from existing classes. This study was conducted over 14 weeks. Statistical analysis in the form of a t test was used to compare the dependent variables between the two groups. The results show that the mean score difference between the pre-test and the post-test for the treatment group was 27.50 while the mean score difference between the treatment group and the control group at the post-test of: i) creativity in writing is 4.90; ii) Creativity in Problem Solving is 5.68, and iii) Creativity in Creating Missionary Motto is 4.93. An ANOVA analysis of a one-way treatment group showed significant differences in student performance based on indicators of creativity. The results of this study suggest that the Isman instructional design model, which pays special attention to teaching from the learner's perspective rather than the content perspective, is suitable for the design and development of the Facebook-based learning to enhance the creativity of Islamic studies students in secondary education in Malaysia. The results of this study should provide information on the promotion of Facebook-based learning. Ifeanyi-obi; Olatunji and Akpala (2014) studied the perceived effects of Facebook on the academic activities of agricultural students at the University of Port Harcourt. Data were collected using a structured questionnaire from 80 randomly selected agricultural students and analysed using descriptive statistical tools, namely frequency, mean and percentages. The result shows that 64% of agricultural

students were women and most of them (87.4%) are in the 21 to 30 age groups. Facebook (94%), BlackBerry Messenger (90%) and WhatsApp (72.5%) are the social media most frequently used by students. The result on the frequency of use of Facebook shows that students visit the Facebook page mainly once every three days (60%). The majority (60%) spend an hour or less on Facebook per day, while the most performed primary action is chatting (36.25%). Agriculture students agree that facilitating networking with other agriculture students (average = 3.00), collaborating with other students (average = 3.00, and ease of information flow (average = 3.41) were the main effects of Facebook on their academic activities. Of the effect of Facebook shows that Facebook positively affects the academic activities of agricultural students (67%). Based on the results of the study, it recommended to encourage the positive effect of Facebook among students while excessive recreational use of Facebook should be discouraged recommended that the positive effect of Facebook among students be encouraged while excessive use Facebook's recreational use should be discouraged.

2.11.4 Effect of Facebook Based Instructional Strategy on Students' Academic Motivation

Shahzad and Bila (2019) assess the impact of the use of Twitter and Facebook on academic motivation among postgraduate students in Lahore, Pakistan. The approach of the study was quantitative research. The field of mass media research was the uses and users for academic research. The method was a paper and pencil questionnaire. 40 Mass Communication Management students were selected because they have a great knowledge of print, electronic or internet communication tools, including social media tools, and they can more critically assess the advantages or disadvantages of

communication progress. Research has shown that Twitter has a slightly smaller role in academic motivation, but Facebook has a very effective role in academic motivation in Lahore, Pakistan. Zakana and Esther (2019) investigated the use of Edmodo and Facebook as SNS to engage upper secondary computer science students in Bayelsa State, Nigeria. The study adopted a quasi-experimental design. Eighty (80) computer science students from S.S.II were purposely sampled and used for the study. Two research questions were answered and two hypotheses were tested at a significance level of 0.05. The instruments used for data collection were titled "Computer Success Test" (CSAT) and "Student Engagement and Motivation towards Facebook and Edmodo Questionnaire" (SEMFEQ). The CSAT pre-test and post-test consisted of 40 multiple choice questions while SEMFEQ consisted of two parts (A and B) and part B consisted of two sections (A and B of 25 items each). The collected data was analysed using the mean and standard deviation to answer the research questions and an independent t test was used for the hypotheses. Cronbach Alpha was used to calculate the internal consistency of SEMFEQ and a reliability coefficient of 0.88 was obtained. The results revealed two dependent variables in this study; engagement and motivation than the first independent variable, Facebook had a significantly higher effect on upper secondary computer science students than Edmodo, the second independent variable. Recommendations made based on the findings, among others, include the integration of these platforms to support classroom instruction.

2.11.5 Effect of WhatsApp Based instructional Strategy on Students' Academic Performance

Amry (2014) examines the impact of WhatsApp mobile social learning on student

outcomes and attitudes towards face-to-face learning in the classroom. The research consisted of two post-test groups solely on the randomized experimental research design. Specifically, this study compares an independent sample of students in an experimental group (15 students) with a control group (15 students) in a university class. The Experimental Group e-learning process is based on WhatsApp's mobile learning activities. The control group e-learning process is without WhatsApp mobile learning activities and only receives face-to-face classroom learning. A learning unit of the same course teaching support is tested with the experimental and control group. The t test was used to compare the differences between the experimental and control groups. The results of the experiment show that there are real differences, at the 0.05 alpha level, in the achievements and attitudes of the experimental group compared to the control group.

Yeboah and Ewur (2014) in their research on the impact of using Whatsapp Messenger on student performance in higher education institutions in Ghana. To do this, 50 students from five higher education institutions were interviewed and 500 questionnaires were administered to students from the same institutions. The study found that WhatsApp, instead of making communication easier and faster, thereby improving the efficient flow of information and sharing of ideas among students, instead had a negative impact on the performance of students from higher education in Ghana. of students time studying, causes problems with procrastination, destroys students' spelling and grammatical construction of sentences, leads to lack of concentration during class, causes difficulty in balancing online activities (WhatsApp) and academic preparation and distracts students from completing their homework and respecting the schedule of their private studies.

Barhoumi (2015) studied the effectiveness of WhatsApp mobile learning activities guided by activity theory on student knowledge management. The researcher adopted a comparison based on an experimental approach between an experimental group (34 students) and a control group (34 students). The experimental group's learning process was based on the continuity between 2 hours of classroom learning and 1 hour of WhatsApp instant messaging mediated learning activities each week. The experience of the control group was 100% classroom-based, without application mediation. The researcher used the t-test to compare the means of the control and experimental groups on the test and the attitudes of the students at 0.05 alpha. This research paper is useful for exploring the effectiveness of mobile technologies in supporting blended learning courses. The result of the research results showed that WhatsApp facilitates online chatting and collaboration from school or home in a blended mobile conference. It also encourages students to insert text and messages to easily share information and knowledge related to the taught course face to face in a blended mobile conference.

2.11.6 Effect of WhatsApp Based instructional Strategy on Students Academic Motivation

Mazana (2018) studied Social Media in the Classroom: WhatsApp, a New Communication Tool for Improved Classroom Interactions. This study used a qualitative scoping research approach, in which 3 in-depth face-to-face interviews and 7 telephone interviews were conducted among students who used WhatsApp as a communication tool in their curriculum and took advantage of the WhatsApp chat content of student teachers. . The study participants were 2015/2016 ICT graduate and undergraduate students at the CBE. Data was obtained through in-depth interviews with 10 randomly selected students

as well as observation of group discussions. Data were qualitatively analysed according to categories and major themes. The results show that WhatsApp was used to share study material in the form of links, notes, homework and lessons, it was used to improve communication between teachers and students, students used the WhatsApp environment to help each other and to respond to learning anywhere and anytime. The benefits achieved have been to stay up to date, facilitate collaborative problem solving, increase motivation to learn, and reduce the cost of material production. Challenges encountered include lack of privacy due to limited options, misuse of the group due to lack of rules, and exclusion of students without smartphones. The implications of using WhatsApp for classroom instruction and student engagement are provided.

Hamad (2017) explores the use of WhatsApp to enhance English language learning "experience to share" by students. The researcher used the analytical descriptive method to conduct this study. The study was conducted at the College of Science & Arts Majarda King Khalid University, Department of English. The study population was 36 1st level students who were taking the Listening & Speaking 1 course in the 1st semester 2013-2014. The researcher used the analytical descriptive method to conduct this study at King Khalid University. A student questionnaire and instructor observation were the data collection tools, the results were manually coded and analysed using SPSS. Almost all of the study's findings supported by the use of WhatsApp to improve student learning and enthusiasm, the use of WhatsApp has helped students develop English skills, enrich their vocabulary and learn mistakes of their comrades, although the study had some disadvantages of the experience such as preparing the material and having discipline in the group.

2.11.7 Effect of Gender on Students' Academic Performance

Adigun, Onihunwa, Irunokhai, Sada and Adesina (2015) studied the effect of gender on the academic performance of students in computer science in secondary schools in the new region of Bussa, Borgu State, State of Niger. A questionnaire consisting of 30 multiple-choice items taken from previous questions of the Secondary School Certificate Exam as defined by the West African Examinations Council in 2014, a multiple-choice question was used as finding aid. The questionnaire was administered to 275 students from private and public schools in the study area. Student responses were scored and scored, then analysed using an independent t-test. The results of the study showed that although male students performed slightly better than female students, it was not significant. This better performance was found to be pronounced in the private school which had the best male brains found in the study area. Based on the results of this study, recommendations were made. Parents are encouraged to provide the right education that they can afford for their children, regardless of their gender. In addition, there should be a deliberate policy of the federal government to encourage the uptake of female students to continue their studies in computer science. In addition, it was recommended that stakeholders in the education sector use these findings and attempt to seek ways to make policies gender responsive. Ezeudu and Obi (2013) examined the effect of gender and location on student achievement in chemistry in secondary schools in Nsukka Local Government Area, Enugu State, Nigeria. The study was guided by three research questions and three hypotheses. The study sample consisted of 827 students comprising 473 men and 354 women. Eight secondary schools were sampled using simple random sampling techniques. A pro forma was the instrument that allowed researchers to copy

the results of the school's past records to the respective schools with the help of school principals. Means and standard deviations were used to answer research questions, and t-test statistics were used to analyse hypotheses. The results showed that male students performed much better than girls in both urban and rural schools. There was also no significant difference in the academic performance of students in urban and rural schools. It was recommended, among other things, that adequate incentives from the federal government, parents and education stakeholders be offered to female students to encourage them to be more successful. Aniodoh and Egbo (2013) studied the effect of gender on student achievement in chemistry using an inquiry role instruction model. The study design is a quasi-experimental research design. Specifically, this is a pre-test, non-equivalent control group design. The design was used because of the non-randomization of subjects. Research subjects were not randomized due to problems with rearrangement or grouping of intact classes. The study population consisted of all senior high school chemistry students (SS2) who were offering chemistry in single-sex public schools in the Enugu Education Zone during the 2010/2011 semester, in the number seven hundred and ninety-seven (797). Single-sex schools were used to avoid gender interactions, as gender is a factor in the study. The sample consisted of one hundred and forty-one chemistry students. A simple random sampling technique was used to select two male schools and two female schools. In each of the sampled schools, all SS2 chemistry students were used as research subjects. The chemistry achievement test (CAT) was used as an instrument by the researcher for the study. The instrument consisted of 40 objective multiple-choice tests developed by the researchers. The CAT was based on the chemical content of the qualitative analysis subdivided into preliminary tests, for cations

and tests for anions. The result of the study's findings revealed that there was no significant difference in the average chemistry achievement scores between male and female students who taught chemistry with ARI, as measured by the test. of chemistry (CAT).

2.11.8 Effect of Gender on Students' Academic Motivation

Chung and Chang, (2017) studied the effect of gender on student motivation and achievement in digital game-based learning. A digital game focused on the theme of emergency first aid is designed for the purposes of this study, according to the curriculum objectives of a content-based instructional course (CBI) in the experiment. By playing the game, learners can acquire both first aid knowledge and language skills. The results show that gender does not have a significant effect on learning outcomes, but causes significant differences in learning motivation. It is found that learners of different genders have better learning outcomes through digital game-based learning. In a moderate gender digital game, the motivation of female learners is significantly higher than that of male learners. The usability of digital play in the study receives a positive response from learners, regardless of their gender. Based on the above results, this study suggests a relationship between gender and digital game-based learning and suggests avenues for further research. Senad (2017) studied the relationship between gender, motivation and achievement in learning English as a foreign language in Bosnia. The research sample consists of 185 students aged ten (fifth grade), fourteen (ninth grade) and eighteen (twelfth grade). The results demonstrate a statistically significant relationship between gender and motivation. Ten-year-olds are the most motivated to

learn English as a foreign language, while eighteen-year-olds are the least motivated. In addition, female students are more successful in learning English as a foreign language than male students at each group / class level. In addition, the results also reveal statistically significant results in measuring the correlation between achievement and motivation and can be of great benefit to teachers, parents and students in taking the most effective approach to learning and teaching. English as a foreign language.

Chan & Norlizah (2017) examined student motivation for science learning and student achievement in science. There were 165 respondents involved who were randomly selected from ten secondary schools in Pahang, Malaysia. A survey questionnaire was used in this study and the instrument used was Student Motivation for Science Learning (SMTSL). The result revealed that students were moderately motivated to learn science and performed average to poor in their science subjects. There was a significant difference in mean student motivation with respect to science learning scores for male students (M = 3.5418, SD = 0.44206) and female students [M = 3.7133, SD = 0.44106; t (163) = 2.361, p = 0.019]. Female students were significantly more motivated than male students to learn science. The result of the study indicated that student motivation for learning science has a significant correlation with student achievement in science ($r = .354$ *, $r^2 = .125$, $p = .000$). Finally, recommendations are addressed to parents, teachers, policy makers and educational administrators and serve as a means to improve student science performance.

2.12 Summary of Literature Reviewed

The above literature review examined the conceptual framework for the effects of three modes of cooperative learning strategy on chemistry students' performance and

motivation in Kaduna metropolis, Nigeria. The review examines in more detail the integration of technology into teaching and learning; cooperative learning concepts; the use of video in education; the use of Facebook in the educational service; the use of WhatsApp in the delivery of instructions; concept of academic success; the use of motivation in the delivery of instruction; the high school chemistry program; problems of teaching chemistry in high school. Studies on the integration of technologies in teaching and learning and how they affect student achievement and motivation were reviewed.

The area of interest for the research is effects of three modes of cooperative learning strategy on chemistry students' performance and motivation in Kaduna metropolis, Nigeria. The goal of the research is to find method of instructional delivery that can increase students' interest to learn as well as enhance their academic performance. The theoretical framework on which the study is based was examined. The theories are; constructivism theory; theory of social interdependence; cognitive development theory; cognitive theory of multimedia learning (CTML); Social cognitive theory; theory of achievement objectives; Walberg's theory of educational productivity. A review of the literature and empirical studies showed that previous studies does not focused on investigating the combine effect of video, Facebook and WhatsApp based cooperative learning instructional strategies on students' academic performance, motivation and gender. Most of the available research related to this area of study focuses on comparing student performance and motivation between those taught with computer technologies such as video, Facebook, and WhatsApp with those taught with conventional teaching methods only.

The research gap is that, there need to carryout research on effect

of video Facebook and WhatsApp based cooperative learning instructional strategies so as to determine the technology that may best enhance students' academic performance and motivation in chemistry. This is because such research is lacking. The research gap therefore prompted the researcher to carry out this research work in this field in order to fill the existing gap. In addition, there is a certain area of difference between the current study and previous ones, most notably in areas such as; sample size, study population, geographic scope of study, field of study, instructional strategies and method of statistical analysis. Many of the previous studies were conducted in developed countries and those in Nigeria were conducted in states other than where the current study was conducted.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the procedures employed in carrying out the study. Therefore, the chapter focused on the following sub – headings; Research Design; population of the study, sample and sampling procedure, instrumentation, development of treatment instrument, procedure for data collection and procedure for data analysis.

3.2 Research Design

The research design adopted for this study is a quasi-experimental design. Quasi experimental type of research design is the most appropriate for the study, because it is a research studies in which participants are selected for different conditions from pre-existing groups (Shadish, 2002). Quasi-experimental 3 X 2 factorial design of post-test is most appropriate for the study. This is because it involves the use of three experimental research groups on two independent variables. Table 3.1 below shows the three factors that were involved in the research work (Facebook, WhatsApp and Video). Each of these factors has two levels which included; performance and motivation.

Table 3.1: 3x2 Factorial Matrix

		Levels	
Factors	Facebook	Performance	Motivation
	Whatsapp	Performance	Motivation
	Video	Performance	Motivation

3.3 Population of the Study

The target population of the research is made up of SSII Chemistry students in Kaduna metropolis in Kaduna state, Nigeria. The target population is about 18,958SSII students from the study area. This population comprises 9322male students and 9636 female students. Kaduna metropolis was chosen because it is located in the heart of the city where many secondary schools have ICT facilities such as good computer lab with internet access and also students that have basic computer skills. The choice of SSII students is also based on the following premises: That the proposed students must have been selected and enrolled for Chemistry subject; That they have been exposed to the teaching of the SSCE Chemistry syllabus and are not pre-occupied with any major examination; That they are expected to have been exposed to some pre-requisite of Chemistry concepts at SSI level. This is vital because certain prerequisite skills need to be acquired before the complex ones. The distribution of the population of the study is presented in table 3.2 below.

Table 3.2: Public and Private Senior secondary school enrolment by gender and LGA in Kaduna Metropolis

Local Government Area	**Enrolment**		
	Boys	**Girls**	**Total**

Chikun	2,838	2525	5363
Kaduna North	1701	745	2446
Kaduna South	1945	2660	4605
Igabi	2838	3706	6544
Grand Total	**9322**	**9636**	**18958**

Source:Kaduna State 2018 Annual School Census Report

3.4 Sample and Sampling Procedure

The nature of the study required that the research sample was purposively selected. This is because a research using computer CDROM for playing the video package and computer for Facebook and WhatsApp applications must necessarily be conducted in schools where computers are available for students use and where the students are computer literate. Also the number of students selected must be based on computer lab capacity and must be able to support cooperative learning instructional strategy class arrangement pattern. In all, three secondary schools were purposefully selected from three local government areas in Kaduna Metropolis. However, 40 students were randomly selected from each of the three secondary school, using stratified random sampling technique. This gives 120 students as the total sample size for the study. Equal numbers of high, medium and low students were equally selected from each group.

Each of the three selected secondary schools were exposed to different treatment (computer technologies) but using the same learning content (Air pollution). Students from Kaduna Capital School were exposed to video based cooperative learning instructional package (VBCLIP), Command Secondary School, Kaduna were exposed to Facebook based cooperative learning instructional package (FBCLIP) and Federal

Government College, Kaduna were exposed to WhatsApp based cooperative learning instructional package (WBCLIP). Some of the criteria important for selection of sampled school for the research work included;

i. Availability of laboratories, ICT facilities and manpower;

ii. Availability of power supply;

iii. School ownership (public and private schools);

iv. Gender composition (mixed schools).

The distribution of the sample of the study is presented in Table 3.3

Table 3.3: Distribution of Sample for the Study

Number of SSII Chemistry Students			
School	**Male**	**Female**	**Total**
A	27	13	40
B	25	15	40
C	24	16	40
Total	**76**	**44**	**120**

Source: Field Survey (2019)

3.5 Instrumentation

The instruments for this research include: chemistry performance test (CPT) and Chemistry Motivation Scale (CMS). The contents of the CPT and CMS were administered to the students in all the three research groups after successful completion of the treatments.

3.5.1 Chemistry Performance Test (CPT)

In order to measure academic performance of the students, CPT was used by the researcher. The test instrument (CPT), is a 20 item multiple choice objective test with five options (A – D) each which was drawn from the past West African Examination

Council (WAEC) Senior Secondary Certificate Examination Chemistry questions. The scores obtained from the 20 items CPT test was converted to 100%. Air Pollution is the chemistry concepts used in the CPT. CPT is a standardized chemistry examination questions from WAEC which had been validated.

3.5.2 Chemistry Motivation Scale (CMS)

In this study CMS was adapted from Academic motivation scale, developed by vallerand, Pelletier, Blias, Brieere, Senecal and Velleres, (1992). It is a 28-items scale used to look at academic motivation of students. The researcher modified the instrument to a 30 item instrument by removing some ambiguous items and adding clearer items. Participants were asked to indicate to what extent each of the items on the scale corresponds to if they are motivated to learning using video, Facebook and WhatsApp using a 4 point likert scale from “4-likert strongly Agreed ” to “1 -Strongly ”disagree. Lowest possible score is 30, while highest possible score is 120.

3.6 Development of the Treatment Instruments

Three treatment groups were involved in the research work. They are; video based Cooperative Learning instructional package (VBCLIP) group, Facebook based cooperative learning instructional package (FBCLIP) group and WhatsApp based Cooperative learning Instructional Package (WBCLIP) group. Treatment for each of the experimental groups is described below.

Table 3.6 Treatment Plan

Weeks	**Group A:**	**Group B:**	**Group C:**
Week One	**Pre-test**	**Pre-test**	**Pre-test**
Week 2	Training Research Assistant (To assist in organizing the student and in ensuring that the research study is without hitches)	Training Research Assistant (To assist in organizing the student and in ensuring that the research study is without hitches)	Training Research Assistant (To assist in organizing the student and in ensuring that the research study is without hitches)
Week 3	Instructional Delivery on Air Pollution (40min)	Instructional Delivery on Air Pollution (40min)	Instructional Delivery on Air Pollution (40min)
Week 4	Completion of Instructional Delivery on Air Pollution	Completion of Instructional Delivery on Air Pollution	Completion of Instructional Delivery on Air Pollution
Week 5	The students used the Video package (to perfectly master the concept)	The students used the Facebook Package (to perfectly master the concept)	The students used the WhatsApp package (to perfectly master the concept)
Week 6	Completion of the use of Video package	Completion of the use of Facebook package	Completion of the use of WhatsApp package
Week	The students used the	The students used the	The students used the

7	Video package	Facebook package	WhatsApp package
Week 8	Completion of the use of Video package	Completion Facebook package	Completion of the use of WhatsApp package
Week 9	**Post-test**	**Post-test**	**Post-test**

3.6.1 Video Based Cooperative Learning Instructional Package (VBCLIP)

VBCLIP involves the use of YouTube video to deliver the treatment on air pollution to students in group one before they were exposed to (CPT). The VBCLIP involved only the use of lesson contents in form of video. VBCLIP was a self-instructional, user friendly and interactive package (contained buttons placed on the bottom of each page, such as Play, stop, Pause, Next and Previous to provide easier control of the package that lasted one hour for each lesson. The package covered six lessons, all from air pollution concept of the Nigerian senior secondary Chemistry curriculum. It was compiled by the researcher with the assistance of a video production expert. ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model of instructional system design was followed in the compilation of the video instructional package. The VBCLIP required that students learn in group of at least 5 individuals (cooperative learning modes) by sharing ideas and encouraging each other for the success of their group. They are required to watch the video on computer in each lesson, discuss the presented concepts, raise questions among

themselves and help each other, especially those who have difficulty in understanding. After the students had completed the task of viewing the video, the teacher intervened by raising some questions and instructed the group members to come out with the best answers that were agreed by all the group members which was presented by leader of the group to the researcher. After all questions were answered and submitted to the teacher by the group members, the teacher read out performance of each group and gave reward to the best performing group. The overall activities for a single lesson took placed within three school lesson period.

3.6.2 Facebook Based Cooperative Learning Instructional Package (FBCLIP)

The second experimental group in the research work was exposed to FBCLIP which involved the use of Facebook groups to delivery instruction to students before they were exposed to the CPT. The FBCLIP involved only the use of lesson contents in form of text. The researcher created ten (10) Facebook group for students. Each Facebook group was composed of four (4) group members. The teacher was added to each of the groups so that he can monitor their interaction and help them in their area of difficulties when the need arise. All the ten groups were assigned tasked by the teacher. All members of the groups were encouraged to be actively involved in the group task by working together and making agreed decision. After completion of all task at the end of each lesson, all group leaders at the same time, forward solution to their tasks to the teacher within a time specified by the teacher. This must first of all has to be collective decision of all group members after embarking on sustained group discussion. The teacher then read out performance of each group and presented reward to the best group. The overall

activities took place within one school period.

3.6.3 WhatsApp Based Cooperative Learning Instructional Package (WBCLIP)

Experimental group three was exposed to WBCIP by using WhatsApp group chat to delivery instruction to the students before they CPT is administered to them. The WBCLIP involved only the use of lesson contents in form of text The researcher created ten (10) WhatsApp groups and added four (4) students to each of the group. He then added himself. The researcher ensures that members of each group work together by monitoring their activities and encouraging them. The researcher's major role is to provide learning content to the learners and act as facilitator on the platform. The major function of the researcher was to guide the students so that they do not go out of the learning content. After completion of all tasks at the end of each lesson, all group leaders at the same time, forward solution to their task to the teacher within a time specified by the teacher. This must first of all has to be collective decision of all group members after embarking on sustained group discussion. The teacher then read out performance of each group and presented reward to the best group. The overall activities take place within one school period.

3.6.4 Development of Lesson Plan

Lesson plans were developed on different topics in air pollution chemistry contents. Different lesson plans were used for each of the three experimental research groups. The lesson plans developed were validated by two Science educators who are experts in the field. Copies of the lesson plan for the three experimental research groups are attached as shown in Appendices A respectively.

3.6.5 Validation Instruments

The face and content validation of the Instrument were done by three experts. These experts included one from the Department of Educational Technology Kaduna Polytechnic who validated the video, based instructional package. The second expert is from the Department of Pure and Applied Chemistry, Kaduna Polytechnic who validated the lesson plan lesson content. The third expert is from the department of measurement and evaluation, Federal College of Education, Technical, Potiskum Yobe State who validated the lesson plan. Validation of the instruments were done to see if they were simplified, comprehensive and enough to cover Air pollution chemistry contents. The video was validated to make sure that it is very interactive and not too bulky. Corrections and comments made by the experts help in enhancing accuracy of the instrument.

3.6.6 Control of Extraneous Variables

The following measures were taken to control some extraneous variables that may arise in this study during the experimental procedure.

i. **Experimental bias:** To eliminate the possibility of students faking when a new teacher is introduced, the regular Chemistry teacher worked alongside the researcher in execution of the experimental procedure as well as administration of CPT and CMS.

ii. **Teacher variable:** To ensure conformity to experimental procedure, experimental conditions and the effective implementation, the researcher prepared lesson plans for the three experimental groups. He discussed extensively the lesson plans and experimental conditions with the teachers. The researcher administered and marked the tests himself.

iii. **Subject interaction;** To eliminate the possibility of interaction between

students in the various groups arising from the use of the same school for all the experimental groups, the researcher used three different schools in three different local government areas in Kaduna Metropolis.

3.7 Procedure for Data Collection

The researcher collected an introductory letter from the Department Of Educational Foundation and Curriculum, Instructional Technology Section, Ahmadu Bello University, Zaria. This letter introduced the researcher to the respective schools for the research study. The researcher presented the letters to the principals thereby getting permission for administration of CAPT as well as CMS. After obtaining the schools consents, the researcher briefed two research assistant on the CAPT administration procedure and the need to make necessary clarification on area that is not clear to the students. Two research assistant assisted the researcher in the administration of CAT and CMS. In each of the three schools, the subject teachers were trained by the researcher on the procedures involved in the administration of CAPT and CMS so that they can be able to assist the research in administration of the instrument. The training was done in each school according to the type of treatment that was given to such schools. When the teachers and students are adequately briefed, trained and have demonstrated competence in the successful implementation of the operational guides to instruction (OGI), then the experimentation commences.

3.8 Procedure for Data Analysis

Demographic variables like age and gender were analysed using frequency and simple percentage, while research questions were answered using mean and standard deviation. Hypotheses one and two were tested using Analysis of Variance (ANOVA),

while hypotheses three and four were tested using independent t test with Statistical Package for Social Sciences (SPSS) version 20. The significance of the null hypotheses was ascertained at 0.05 alpha level of significance.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Introduction

This chapter presents the analysis of the data collected from administration of Chemistry Academic Achievement Test (CAPT) and Chemistry Motivation Scale (CMS) after treatment. Descriptive statistics using mean and standard deviation were used to answer the four research question while the hypotheses were tested using Analysis of Variance (ANOVA) at 0.05 alpha level of significance.

4.2 Demographic Variables

Table 4.1: Distribution of Respondents by Treatment groups

Groups	Frequency	Percent
Video	40	33.3
Facebook	40	33.3

WhatsApp	40	33.3
Total	**120**	**100.0**

Table 4.1 shows the distribution of respondents based on the treatment groups. Each of the three treatment groups (Video, Facebook and WhatsApp) has 40 respondents representing 33.3 percent each, and they received video, Facebook and WhatsApp based cooperative learning instructional package respectively.

Table 4.2: Distribution of Respondents by Gender

Gender	Frequency	Percent
Male	72	60.0
Female	48	40.0
Total	**120**	**100.0**

Table 4.2 shows the distribution of respondents based on age. 72 respondents representing 60% are male while 48 respondents representing 40% are female. This revealed that majority of the respondents are male.

Table 4.3: Distribution of Respondents by Age

Age	Frequency	Percent
12-14	15	12.5
15-17	92	76.7

18 and above	13	10.8
Total	**120**	**100.0**

Table 4.3 shows the distribution of respondents based on age. 15 respondents representing 12.5% falls with the age bracket of 12-14 years, 92 respondents representing 76.7% falls within the age bracket of 15-17 while only 13 respondents representing 10.8% are 18 years and above. This indicates that majority of the respondents' falls within the age gap of 15-17.

4.3 Analyses of Research Questions

The study was guided by the search for answers to the four research questions raised in chapter one of this study. These research questions are answered as follows:

Research Question 1: Is there significant difference in the performance mean scores of students taught using video, Facebook and WhatsApp based cooperative learning instructional package?

In answering research question one; mean scores of students in the three groups (video, Facebook and WhatsApp) were analyzed using mean and standard deviation as shown in Table 4.4.

Table 4.4: Mean and Standard Deviations of Students performance taught using video, Facebook and WhatsApp.

Variable	Groups	N	Mean	Std. Deviation
	Video	40	51.5750	18.03115

Chemistry Performance	Facebook	40	48.0500	15.48523
	WhatsApp	40	49.9250	13.59560
	Total	**120**	**51.5750**	**18.03115**

Table 4.4 showed the mean and standard deviation of the student's performance in the three groups (Video, Facebook and WhatsApp). From the result, it can be deduced that the mean score and standard deviation of students performance taught using Video based Instructional package is 51.5750 and 18.03115 while the mean score and standard deviation of students performance taught using Facebook based Instructional package is 48.0500 and 15.48523. Similarly, the mean score and standard deviation of student's performance taught using WhatsApp based Instructional package is 49.9250 and 13.59560. The mean scores of students taught using Video based Instructional package is higher than Facebook and WhatsApp. This revealed that there was difference in performance of students taught using Video, Facebook and WhatsApp based cooperative learning instructional packages.

Research Question 2: Is there significant difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional package?

In answering research question one; mean scores of students in the three groups (video, Facebook and WhatsApp) were analyzed using mean and standard deviation as shown in Table 4.5.

Table 4.5: Mean and Standard Deviations of Students Motivation in video, Facebook and WhatsApp groups.

Variable	**Groups**	**N**	**Mean**	**Std. Deviation**

	Video	40	79.5250	13.68883
Chemistry Motivation	Facebook	40	87.1000	13.10862
	WhatsApp	40	87.0750	11.02535
	Total	**120**	**79.5250**	**13.05305**

Table 4.5 showed the mean and standard deviation of the student's motivation in the three groups (Video, Facebook and WhatsApp). From the result, it can be deduced that the mean score and standard deviation of students motivation taught using Video based Instructional package is 79.5250 and 13.68883 while the mean score and standard deviation of students motivation taught using Facebook based Instructional package is 87.1000 and 13.10862. Similarly, the mean score and standard deviation of student's motivation taught using WhatsApp based Instructional package is 87.0750 and 11.02535. The mean scores of students taught using Facebook and WhatsApp based Instructional package is higher than those taught using Video based Instructional package. This revealed that there was differences in motivation of students taught using Video, Facebook and WhatsApp based cooperative learning instructional Packages.

Research Question 3: Is there gender difference in performance of students taught using video, Facebook and WhatsApp based cooperative learning instructional package?

In answering research question three; mean performance scores of students in the two groups (male and female) were analyzed using mean and standard deviation as shown in Table 4.6.

Table 4.6: Mean and Standard Deviations of male and female students Performance taught using video, Facebook and WhatsApp based cooperative learning instructional package.

	Gender	N	Mean	Std. Dev.
Chemistry Performance	Male	74	48.2973	15.79815
	Female	49	51.5510	15.46644

Table 4.6 showed the mean and standard deviation of male and female student's performance. From the result, it can be deduced that the mean performance score of male student taught using Video, Facebook and WhatsApp based Instructional package is 48.2973 while the mean score of female students performance taught using Video, Facebook and WhatsApp based Instructional package is 51.5510. Similarly, the standard deviation for male is15.579815 and 15.46644 for female. The mean scores of female students are higher than that of male. This revealed that there was differences in performance of male and female students taught using Video, Facebook and WhatsApp based cooperative learning instructional Packages.

Research Question 4: Is there gender difference in motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional package?

In answering research question four; mean motivation scores of students in the two groups (male and female) were analyzed using mean and standard deviation as shown in Table 4.7.

Table 4.7: Mean and Standard Deviations of Male and Female Students motivation taught using video, Facebook and WhatsApp based cooperative learning instructional package.

Variable	Gender	N	Mean	Std. Dev.
Chemistry Motivation	Male	74	84.6351	14.18621
	Female	49	84.6939	11.46590

Table 4.7 showed the mean and standard deviation of male and female student's Motivation. From the result, it can be deduced that the mean score of motivation of male

student taught using Video, Facebook and WhatsApp based Instructional package is 84.6351while the mean score of female students motivation taught using Video, Facebook and WhatsApp based Instructional package is 84.6939. Similarly, the standard deviation for male is14.18621 and 11.46590 for female. The mean scores of female students is almost the same with that of male (difference of 0.0588). This revealed that there was no difference in motivation of male and female students taught using Video, Facebook and WhatsApp based cooperative learning instructional Packages.

4.3 Null Hypotheses Testing

Hypothesis One: There is no difference in the performance mean scores of students taught using video, Facebook and WhatsApp based cooperative learning instructional package.

Table 4.8: ANOVA results for the differences in Performance mean scores among the three groups (video, Facebook and WhatsApp).

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	154.349	2	77.174	.310	.734
Within Groups	29859.326	120	248.828		
Total	30013.675	122			

Results of the ANOVA analysis in the above table revealed that there is significant difference in Chemistry performance of students when taught using video, Facebook and

WhatsApp based cooperative learning instructional package with (F= .310, p= .734). Mean square between groups is 154.349 and mean square within groups is 29859.329. Therefore the null hypothesis which states that there is no difference in the motivation of students taught using video based, Facebook and WhatsApp based cooperative learning instructional package is hereby rejected.

Table 4.9: Post Hoc Test
Multiple Comparisons

Dependent Variable: Chemistry Performance
Scheffe

(I) GROUPS	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Video based	Facebook	2.67093	3.46517	.744	-5.9179	11.2598
	WhatsApp	.79593	3.46517	.974	-7.7929	9.3848
Facebook	Video based	-2.67093	3.46517	.744	-11.2598	5.9179
	WhatsApp	-1.87500	3.52723	.868	-10.6177	6.8677
WhatsApp	Video based	-.79593	3.46517	.974	-9.3848	7.7929
	Facebook	1.87500	3.52723	.868	-6.8677	10.6177

The post hoc scheffe test showed that video and Facebook had a mean difference of 2.67093, Video and WhatsApp had .79593, Facebook and Video had a mean difference of 2.67093, Facebook and WhatsApp had 1.87500, WhatsApp and Video had a mean difference of .79593, and also WhatsApp and Facebook had 1.87500.

Hypothesis Two: There is no difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional package.

Table 4.10: ANOVA results for the differences in student's motivation among the three groups (video, Facebook and WhatsApp).

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1350.121	2	675.060	4.122	.019

Within Groups	19651.538	120	163.763
Total	21001.659	122	

Results of the ANOVA analysis in the above table revealed that there is significant difference in Chemistry Motivation of students when taught using video, Facebook and WhatsApp based cooperative learning instructional package with (F= 4.122, p=0.019). Mean square between groups is 675.060 and mean square within groups is 163.763. Therefore the null hypothesis which states that there is no difference in the motivation of students taught using video based, Facebook and WhatsApp based cooperative learning instructional package is hereby accepted and rejected.

Table 4.11: Post Hoc Tests
Multiple Comparisons

Dependent Variable: Chemistry Motivation
Scheffe

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Video based	Facebook	-6.96047	2.81114	.050	-13.9282	.0073
	WhatsApp	-6.93547	2.81114	.051	-13.9032	.0323
Facebook	Video based	6.96047	2.81114	.050	-.0073	13.9282
	WhatsApp	.02500	2.86149	1.000	-7.0676	7.1176
WhatsApp	Video based	6.93547	2.81114	.051	-.0323	13.9032
	Facebook	-.02500	2.86149	1.000	-7.1176	7.0676

The post hoc scheffe test showed that video and Facebook had a mean difference of 6.96047, Video and WhatsApp had 6.93547, Facebook and Video had a mean

difference of 6.96047, Facebook and WhatsApp had .02500, WhatsApp and Video had a mean difference of 6.93547, and also WhatsApp and Facebook had .02500.

Hypothesis three: There is no gender difference in the performance of students taught using video Facebook and WhatsApp based cooperative learning instructional package

Table 4.12: Independent t test statistics on gender difference in the performance of students taught using video Facebook and WhatsApp based cooperative learning instructional package

Variable	Gender	N	Mean	Std. Dev	df	t-cal.	p(sig)
Chemistry Performance	Male	74	48.29	15.79	121	1.128	.262
	Female	49	51.55	15.47			

Calculated p > 0.05, calculated t <1.96 at df121

The result of the Independent t test statistics showed that there is no significant gender difference in the performance of students taught using video Facebook and WhatsApp based cooperative learning instructional package (t= 1.128, p= .262). Their computed mean scores are 48.29 for male and 51.55 for female. This implies that the mean difference of 3.26 in favor of female is not significant. Therefore the null hypothesis which states that there is no gender difference in the performance of students taught using video Facebook and WhatsApp based cooperative learning instructional package is hereby retained.

Hypothesis Four: There is no gender difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional package.

Table 4.13: Independent t test statistics on gender difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional package

Variable	Gender	N	Mean	Std. Dev	df	t-cal.	p(sig)
Chemistry Motivation	Male	74	84.64	14.186	121	0.24	.093
	Female	49	84.69	11.466			

Calculated p > 0.05, calculated t < 1.96 at df 121

The result of the Independent t test statistics showed that there is no significant difference in gender in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional package(t= 0.24, p= .093). Their computed mean scores are 84.64 for male and 84.69 for female. This shows the mean difference between the male and the female is 0.05, signifying that there is no significant difference in motivation between male and female. Therefore the null hypothesis which states that there is no gender difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional package is hereby retained.

4.4 Summary of Findings

1. There was difference in Chemistry academic performance of students taught using video, Facebook and WhatsApp based cooperative learning instructional package. However, this difference is in favour of video based group but it is not statistically significant (F= 0.310, p=0.734 which is less greater than 0.05).
2. There was difference in Chemistry Motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional package.

However, the difference was in the favour of Facebook and WhatsApp based group but it is not statistically significant (F= 4.122, p=0.019 is less than 0.05).

3. There was gender difference in the performance of students taught using video Facebook and WhatsApp based cooperative learning instructional package. However, the difference was in favour of female but it is not statistically significant (t= 1.128, p= .262 which is less than 0.05).
4. There was no gender difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional package. However, the difference was in favour of female but it is not statistically significant (t= 0.24, p= .093 which is greater than 0.05).

4.5 Discussion of the Findings

The result of findings of the research work indicated that video based cooperative learning instructional package has significant effect on students' academic performance. This finding agree with that of Abbey and Okorogba (2017) who found out that video based instructional strategy has significant effect on students' academic performance. Also the result of the findings of the research work showed that the use of WhatsApp based instructional strategy has significant effect on students' academic performance. This result is in agreement with the result of Alias; Siraj; Daud and Hussin, (2013) who found that Facebook based instructional strategy enhance students learning and creativity. The result of the findings of the study revealed WhatsApp instructional strategy has significant effect on students' academic performance. This findings in agreement with the findings of Amry (2014) who found that Facebook based instructional strategy has significant effect on students' academic performance. The reason for these similarities may be because the

researchers used students of the same age or due to other factors such as socio-economic background and gender composition of the students.

Findings of the study revealed that the use of Facebook based instructional strategy has tremendous effect on students' academic motivation. This result in agreement with the result of findings of Ljubojevic; Vaskovic, Stankovic and Vaskovic (2014) who found that the use of instructional video in teaching and learning process can significantly enhance students' motivation. This result of findings is in agreement with the findings of Park and Jung (2016) who explore the Use of Video-clips for motivation building in a Secondary School EFL Setting. Fifteen Korean EFL students at the secondary school context participated in an 8-week English program, who found that after exposure to video based learning, students became more motivated, especially in terms of gaining a positive attitude for the English language and culture, and competitive group activities that followed the watching of video materials positively influenced student participation. The reason for the agreement may be because the students were taught in using different subjects but the same technology.

The result of the findings of the research work also showed that Facebook based instructional strategy significantly enhances students' motivation. This results is in agreement with the result of findings of Shahzad and Bila (2019) who found out that Facebook has significant effect on students' motivation to learn, among 40 mass communication post post-graduate students' in Lahore Pakistan. The reason for the agreement may be because the students may both have same level of familiarity with the computer technology used. It is also in agreement with the result of findings of Zakana and Esther (2019) who found out that Facebook and

Edmodo significantly increases student's motivation in learning among senior secondary Computer Science students in Bayelsa State, Nigeria. The reason for the agreement in the result of the findings may be because the researches were both carried out on secondary school students. The result of the findings of the research work showed that WhatsApp based instructional package has significant impact on students' motivation. This is in agreement with the result of findings of Mazana (2018) who found that WhatsApp based instructional strategy significant impact on students' motivation as it enhances students' ability to learn by increasing their motivation. This result was discovered after they diploma and bachelor degree students in ICT intake 2015/2016 at the CBE . The result of this findings is also in agreement with the result of findings of Hamad (2017) who found that WhatsApp based instructional package increases students motivation in his study which was carried out in College of Science & Arts Majarda King Khalid University, English Department, on 36 female students from 1st level who were studying Listening & Speaking 1 course in the 1st semester. The reason for the agreement may be because both researchers taught students effectively via the same type of technology until they are familiar with the learning contents. The result of the findings of the research work showed that gender has no significant difference on the performance scores of students taught using video, Facebook and WhatsApp based cooperative learning instructional package. This is in agreement with the result of the findings of Adigun, Onihunwa, Irunokhai, Sada and Adesina (2015) who found that there is no difference in the performance of male and female students in computer studies in secondary schools in new Bussa, Borgu local government area of

Niger state. This agreement may be because the study was carried out using both government and private secondary schools. The result of the findings of the research is also in disagreement and agreement with the findings of Ezeudu and Obi (2013) who found that male students achieved significantly better than the female students in both urban and rural schools, but there was no significant difference in the academic performance of student in urban and rural schools, after they examined effect of gender and location on students' Performance in chemistry in secondary schools in Nsukka local government area of Enugu state, Nigeria. This conflicting result may be as a result of socio-economic differences between the two locations where the study was carried out. The result of the findings of the research work is in agreement with findings of Aniodoh and Egbo (2013) who found that there is no significant difference in the mean performance scores in chemistry between male and female student taught chemistry with IRA as measured by chemistry academic performance Test (CAPT) in public single sex schools in Enugu Education Zone. This agreement may be because both studies were carried out using chemistry as an instructional subject.

The result of the findings of the research work indicated that there is no gender difference in the motivation of students taught using video, Facebook and WhatsApp based cooperative learning instructional package. This is in disagreement with the finding of Liang-Yi and Rong-Chi (2017) who found that gender has no significant effect on the learning performance, but has significant differences in learning motivation. This was discovered in their study which was aimed at investigated the effect of gender on motivation and students' performance in digital

game-based learning. This disagreement may be because the study was carried out using different technology and in different country.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the study, conclusion drawn from the findings and recommendations based on the findings of this study, contribution to knowledge, limitations of the Study and Suggestions for Further Studies.

5.2 Summary

This study investigated the effects effect of effects of three modes of cooperative learning strategy on chemistry students' performance and motivation in Kaduna Metropolis, Nigeria. The study was guided by two objectives, two research questions and two corresponding null hypotheses. Related literatures were reviewed under conceptual framework, theoretical framework and review of empirical studies. Concepts like Technology Integration in Teaching and Learning, Cooperative Learning, the use of Video in Instructional Delivery; the use of Facebook in Instructional Delivery, the Use of WhatsApp in Instructional Delivery; Concept of Academic Performance and the Use of Motivation in Instructional Delivery were vividly explained. Under the theoretical framework for the study, theories like constructivism theory, social interdependence theory, cognitive Elaboration Theory, cognitive Theory of Multimedia Learning (CTML), social cognitive theory, Performance Goal theory and Walberg's Theory of Educational Productivity were elaborately reviewed and linked to this study.

From the reviewed literature, the researcher observed that previous research in this field are centered on effect of Facebook on students' academic performance, effect of WhatsApp on student performance, effect of Facebook and WhatsApp on students' academic performance and effect of three modes of video based cooperative learning modes on students' academic performance among others. No research that compare video, Facebook and WhatsApp in cooperative learning on students' academic performance and motivation. Most previous research focused on comparing Facebook and traditional method of teaching, WhatsApp and traditional method of teaching or video and traditional method of teaching.

Quasi-experimental 3 X 2 factorial design of posttest is most appropriate for the study. This is because it involves the use of three experimental groups on two independent variables. Three treatment groups were involved in the research work. They are; video based Cooperative Learning instructional package (VBCLIP), Facebook based cooperative learning instructional package (FBCLIP) and WhatsApp based Cooperative learning Instructional Package (WBCLIP). The instrument used was pilot tested and data obtained were analyzed to determine the reliability of the instrument. The data generated from the study were analyzed using mean and standard deviation (SD) and Analysis of Variance (ANOVA) was used to test all the hypotheses at 0.05 probability level.

Chapter four presented the analysis data collected by the researcher through the use of Chemistry Academic Achievement Test (CAPT) and Chemistry Motivation Scale (CMS) after the three research groups were exposed to treatment. Mean and standard deviation were used to answer the four research question while the hypotheses were tested using Analysis of Variance (ANOVA) at 0.05 alpha level of significance. Chapter five presented the summary of the study, conclusion drawn from the findings of the study and recommendations, contributions to knowledge, limitations of the study and suggestion for further studies.

5.3 Conclusion

Findings of the research provided the ground for the researcher to concluded that video based cooperative learning instructional package is more effective in enhancing students' academic performance; Facebook and WhatsApp based cooperative instructional packages are more effective in enhancing students motivation in learning; Female students perform slightly higher than male students. With this improvement in

students' academic performance and motivation in chemistry, adequate provision of computer, mobile devices, internet and stable electricity supply as well as training of teachers and students on utilization of these instructional packages will make a huge difference in enhancing students' performance in chemistry in Kaduna state.

5.4 Recommendations

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

1. Video, Based Cooperative Learning Instructional package should be used to teach so as to enhance students' academic performance.
2. Teachers should incorporate video, Facebook and WhatsApp Based Cooperative Learning Instructional packages as part of their instructional delivery strategy in order to motivate and enhance students learning.
3. Irrespective of gender video, Facebook and WhatsApp Based Cooperative Learning Instructional packages should be used to teach in order to enhance students' academic performance.
4. Video, Facebook and WhatsApp Based Cooperative Learning Instructional packages should be used to teach students irrespective of gender so as to increase their academic motivation.

5.5 Contribution to Knowledge

This research work titled "effect of three modes of cooperative learning strategy on chemistry students' performance and motivation in Kaduna Metropolis, Nigeria" can contribute immensely to the body of knowledge, more especially in the field of ICT integration in teaching and learning; integration of cooperative learning in ICT for

effective teaching and learning process as well as in the use of video, WhatsApp and Facebook based learning package in instructional delivery. This is because the result of findings of the research pointed out that, incorporative computer technologies such as video, Facebook and WhatsApp in cooperative learning for instructional delivery can tremendously enhance students' performance and motivation in Chemistry subjects in secondary school.

5.6 Limitations of the Study

The study is limited to the effects of three modes of cooperative learning strategy on chemistry students' performance and motivation in Kaduna metropolis, Nigeria. The study did not include junior secondary school and therefore may not be applicable to junior secondary schools in Kaduna state. The study was also limited to Chemistry which is one of the core science subject and may not be applicable to social science subject. The area of the study was Kaduna state and it was delimited to Kaduna Metropolis, thus it may not be applicable to other state in the North-west geopolitical zone of the country.

5.7 Suggestions for Further Studies

The findings of this study had generated some areas for further research. Against this background, further research could be undertaken to:

1. Determine effect of technology integration on students' performance in North Eastern states of Nigeria.
2. Examine the effect of technology integration on students' academic performance and retention in chemistry.

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APPENDIX A

Lesson plan for groups (VBCLIP, FBCLIP and WBCLIP)

In this strategy, the students:

i. Work in a mixed skill group of five students each.

ii. Work together as a team

iii. Make a decision by agreement

iv. Contribute ideas and suggestions together

v. Complete homework together

vi. Seek help mainly from group members

vii. Obtain a common teacher reward as a group

Seating arrangement

The seating arrangement should be that each group occupies a seating area of one square meter and a space of one meter is left between each group.

Instruction.

When presenting the video, Facebook and WhatsApp based instructions, the teacher follows all the steps outlined in the lesson plan. This is necessary to ensure a step-by-step and effective instruction.

Lesson: 1

Subject: Chemistry

Topic: Composition of Air

Class: SSII

Duration: 45 minutes

Date:_____

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

i. Explain the composition of air.
ii. State method of separating pure nitrogen and oxygen
iii. Give evidence that air is a mixture.

Entry Behaviour: - The students are familiar with water pollution as well as causes of water pollution and its hazards.

Entry behaviour test: - Explain water pollution as well as causes of water pollution and its hazards.

Instructional materials: Matches and candle

Instructional procedure:-

Step1.

The teacher forms heterogeneous groups of 5 students. Each group selects a leader /recorder and rules guiding the group are made clear to all. The teacher then introduces composition of air.

The teacher then asks the question:

Explain the composition of air.

Each group will be asked to explain the composition of air as they brainstorm within.

The group the researcher asks leading questions cantered around the task to drive the points home.

Activity 1:

Using the worksheets, each student within the group attempts to explain the composition of air. The group leader collates and works together with other members of the group to select the best explanation of the concept.

Step 2:

The researcher ask the groups to state the method of separating pure nitrogen and oxygen.

Activity2:

Each of the groups will be given ten minutes to state the method of separating pure nitrogen. The group leader will take record of each member's response. The group members cooperate to bring out the best answer.

Step 3:

The teacher asks the students to describe the importance of air to both plants and animals. The group will work together to reach a consensus of opinion about the meaning of noble gases. Students who do not understand will be helped by others in the group.

Activity 3:

The groups work together to give evidence that air is a mixture with the aid of the instructional material using their worksheets.

Step 4:

The teacher asks the students to develop their own concept of what was learnt by putting the concepts together (Explain the composition of air, State method of separating pure nitrogen and oxygen, give evidence that air is a mixture).

Activity 4:

Each group draws their idea on concepts that were cooperatively. The teacher supervises each group guides them through leading questions and responds to their questions.

Step 5: **Evaluation**

The teacher asks the leader of group to:

i. Explain the composition of air.
ii. State method of separating pure nitrogen and oxygen
iii. Give evidence that air is a mixture.

Lesson: 2

Subject: Chemistry

Topic: Combustion of Substance in Air

Class: SS2

Duration: 45 minutes

Date:_____

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

i. Define combustion of substance.
ii. State condition that can lead to incomplete combustion.
iii. Explain what is flame
iv. Differentiate between luminous and non-luminous flame

Entry Behaviour: - The students are familiar with composition of air.

Entry behaviour test: - Explain the composition of air.

Instructional materials: Matches, Candle, jar.

Instructional procedure:-

Step1. The teacher forms heterogeneous groups of 5 students. Each group selects a leader /recorder and rules guiding the group are made clear to all. The teacher then introduces concept of combustion of substances.

The teacher then asks the question:

What is combustion of substances?

Each group will be asked to figure out meaning of the combustion of substances as they brainstorm within. The group the teacher asks leading questions cantered around the combustion of substances to drive the points home.

Activity 1:

Using the worksheets, each student within the group attempts explain the concept of combustion of substances. The group leader collates and works together with other members of the group to select the best explanation of the concept.

Step 2:

The teacher will ask the groups to explain the state condition that can lead to incomplete combustion.

Activity 2:

Each of the groups will be given ten minutes to figure out the conditions that lead to incomplete combustion of substances. The group leader will take record of each member's response. The group members cooperate to bring out the best answer.

Step 3:

The teacher asks the students to explain the term flame. The group will work together to reach a consensus of opinion about the meaning of flame. Students who do not understand will be helped by others in the group.

Activity 3:

The groups work together to explain the meaning of flame by meaning of flame with the aid of the instructional material using their worksheets.

Step 4:

The teacher asks the students to explain the differences between luminous and non-luminous flame. The group will work together to reach a consensus of opinion about the task. Students who do not understand will be helped by others in the group.

Activity 4:

The groups work together to explain the difference between luminous and non-luminous flame with the aid of the instructional material using their worksheets.

Step 5:

The teacher asks the students to develop their own concept of what was learnt by putting the concepts together (combustion of substance, condition that can lead to incomplete combustion, meaning of flame, differences between luminous and non-luminous flame)

Activity 5:

Each group draws their idea on concepts that were cooperatively. The teacher supervises each group guides them through leading questions and responds to their questions.

Step 6: **Evaluation**

The teacher asks the leader of group to:

i. Define combustion of substance.

ii. State condition that can lead to incomplete combustion.

iii. Explain what is flame

iv. Differentiate between luminous and non-luminous flame

Lesson: 3

Subject: Chemistry

Topic: Corrosion Of Metals

Class: SSII

Duration: 45 minutes

Date:_____

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

i. What is corrosion of metals?
ii. Factors that causes corrosion of metals.
iii. Ways of preventing rusting of iron
iv. Differentiate between rusting and burning

Entry Behaviour: - The students are familiar with combustion of substances..

Entry behaviour test: - Define combustion of substances.

Instructional materials: Iron and water.

Instructional procedure:-

Step 1.

The teacher forms heterogeneous groups of 5 students. Each group selects a leader /recorder and rules guiding the group are made clear to all. The teacher then introduces corrosion of metals.

The teacher then asks the question:

What is corrosion of metals?

Each group will be asked to figure out meaning of the corrosion of metals as they brainstorm within. The group the teacher asks leading questions cantered around the task to drive the points home.

Activity 1:

Using the worksheets, each student within the group attempts explain the concept of corrosion of metals. The group leader collates and works together with other members of the group to select the best explanation of the concept.

Step 2:

The teacher will ask the groups to explain the state factors that causes corrosion of metals.

Activity 2:

Each of the groups will be given ten minutes to figure out the factors that cause corrosion of metals. The group leader will take record of each member's response. The group members cooperate to bring out the best answer.

Step 3:

The teacher asks the students to state ways of preventing rusting of iron. The group will work together to reach a consensus of opinion about the meaning of flame. Students who do not understand will be helped by others in the group.

Activity 3:

The groups work together to explain the ways of preventing rusting of iron with the aid of the instructional material using their worksheets.

Step 4:

The teacher asks the students to explain the differences between rusting and non-combustion. The group will work together to reach a consensus of opinion about the task. Students who do not understand will be helped by others in the group.

Activity 4:

The groups work together to explain the difference between rusting and combustion flame with the aid of the instructional material using their worksheets.

Step 5:

The teacher asks the students to develop their own concept of what was learnt by putting the concepts together (What is corrosion of metals? Factors that causes corrosion of metals, Ways of preventing rusting of iron, differentiate between rusting and burning).

Activity 5:

Each group draws their idea on concepts that were cooperatively. The teacher supervises each group guides them through leading questions and responds to their questions.

Step 6; Evaluation

The teacher asks the leader of group to:

i. What is corrosion of metals?

ii. Factors that causes corrosion of metals.

iii. Ways of preventing rusting of iron

iv. Differentiate between rusting and burning

Lesson: 4

Subject: Chemistry

Topic: Atmospheric carbon IV oxide, respiration in living organisms and photosynthesis

Class: SSII

Duration: 45 minutes

Date: _____

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

i. What is atmospheric carbon IV oxide?
ii. Explain respiration in living organisms.
iii. Describe photosynthesis

Entry Behaviour: - The students are students are familiar with difference between combustion and rusting.

Entry behaviour test: - Differentiate between combustion and rusting.

Instructional materials: Light bulb, Green Plant.

Instructional procedure:-

Step1.

The teacher forms heterogeneous groups of 5 students. Each group selects a leader /recorder and rules guiding the group are made clear to all. The teacher then introduces corrosion of metals.

The teacher then asks the question:

What is atmospheric carbon IV oxide?

Each group will be asked to figure out meaning of the atmospheric carbon IV oxide as they brainstorm within.

Activity 1:

Using the worksheets, each student within the group attempts explain the concept of atmospheric carbon IV oxide. The group leader collates and works together with other members of the group to select the best explanation of the concept.

Step 2:

The teacher will ask the groups to explain respiration in living organisms.

Activity2:

Each of the groups will be given ten minutes to figure out explain respiration in living organisms. The group leader will take record of each member's response. The group members cooperate to bring out the best answer.

Step 3:

The teacher asks the students to describe the term photosynthesis. The group will work together to reach a consensus of opinion about the meaning of photosynthesis. Students who do not understand will be helped by others in the group.

Activity 3:

The groups work together to explain the term photosynthesis with the aid of the instructional material using their worksheets.

Activity 4:

The teacher asks the students to develop their own concept of what was learnt by putting the concepts together (What is atmospheric carbon IV oxide?, Explain reparation in living organisms, Describe photosynthesis)

Activity 4:

Each group draws their idea on concepts that were cooperatively. The teacher supervises each group guides them through leading questions and responds to their questions.

Step 5: **Evaluation**

The teacher asks the leader of group to:

i. What is atmospheric carbon IV oxide?
ii. Explain reparation in living organisms.
iii. Describe photosynthesis

Lesson: 5

Subject: Chemistry

Topic: atmospheric nitrogen and noble gases

Class: SSII

Duration: 45 minutes

Date: _____

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

v. What is atmospheric nitrogen?

vi. State the importance of atmospheric nitrogen

vii. Explain what is noble gases

viii. Enumerate uses of noble gases.

Entry Behaviour: - The students are familiar with atmospheric carbon IV oxide

Entry behavior test: - What is atmospheric carbon IV oxide?

Instructional materials: Matches and candle

Instructional procedure:-

Step1.

The teacher forms heterogeneous groups of 5 students. Each group selects a leader /recorder and rules guiding the group are made clear to all. The teacher then introduces corrosion of metals.

The teacher then asks the question:

What is atmospheric nitrogen?

Each group will be asked to figure out meaning of the atmospheric nitrogen as they brainstorm within.

Activity 1:

Using the worksheets, each student within the group attempts explain the concept of atmospheric nitrogen. The group leader collates and works together with other members of the group to select the best explanation of the concept.

Step 2:

The teacher will ask the groups to state the importance of atmospheric nitrogen.

Activity2:

Each of the groups will be given ten minutes to figure out importance of atmospheric nitrogen. The group leader will take record of each member's response. The group members cooperate to bring out the best answer.

Step 3:

The teacher asks the students to describe the term noble gases. The group will work together to reach a consensus of opinion about the meaning of noble gases. Students who do not understand will be helped by others in the group.

Activity 3:

The groups work together to explain the term noble gases with the aid of the instructional material using their worksheets.

Step 4:

The teacher asks the students to enumerate uses of noble gases. The group will work together to reach a consensus of opinion about the uses of noble gases. Students who do not understand will be helped by others in the group.

Activity 4:

The groups work together to explain the uses of noble gases with the aid of the instructional material using their worksheets.

Step 5:

The teacher asks the students to develop their own concept of what was learnt by putting the concepts together (What is atmospheric nitrogen, State the importance of atmospheric nitrogen, Explain what is noble gases, Enumerate uses of noble gases).

Activity 5:

Each group draws their idea on concepts that were cooperatively. The teacher supervises each group guides them through leading questions and responds to their questions.

Step 6: **Evaluation**

The teacher asks the leader of group to:

i. What is atmospheric nitrogen?

ii. State the importance of atmospheric nitrogen

iii. Explain what is noble gases

iv. Enumerate uses of noble gases.

Lesson: 6

Subject: Chemistry

Topic: Water vapour in the air and air dissolved in water

Class: SSII

Duration: 45 minutes

Date: _____

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

i. What is water vapour
ii. Describe saturation pressure of water
iii. Enumerate importance of air to both plants and animals

Entry Behaviour: - The students are students are familiar with atmospheric carbon IV oxide

Entry behaviour test: - What is atmospheric carbon IV oxide?

Instructional materials: Matches and candle

Instructional procedure:-

Step1.

The teacher forms heterogeneous groups of 5 students. Each group selects a leader /recorder and rules guiding the group are made clear to all. The teacher then introduces corrosion of metals.

The teacher then asks the question:

What is water vapour?

Each group will be asked to figure out meaning of the water vapour as they brainstorm within. The group the teacher asks leading questions centered around the task to drive the points home.

Activity 1:

Using the worksheets, each student within the group attempts explain the concept of water vapour. The group leader collates and works together with other members of the group to select the best explanation of the concept.

Step 2:

The teacher will ask the groups to explain saturation pressure of water.

Activity2:

Each of the groups will be given ten minutes to explain saturation pressure of water. The group leader will take record of each member's response. The group members cooperate to bring out the best answer.

Step 3:

The teacher asks the students to describe the importance of air to both plants and animals. The group will work together to reach a consensus of opinion about the meaning of noble gases. Students who do not understand will be helped by others in the group.

Activity 3:

The groups work together to explain the importance of air to both plants and animals with the aid of the instructional material using their worksheets.

Step 4:

The teacher asks the students to develop their own concept of what was learnt by putting the concepts together (what is water vapour, Describe saturation pressure of water, Enumerate importance of air to both plants and animals).

Activity 4:

Each group draws their idea on concepts that were cooperatively. The teacher supervises each group guides them through leading questions and responds to their questions.

Step 5: **Evaluation**

The teacher asks the leader of group to:

i. What is water vapour
ii. Describe saturation pressure of water
iii. Enumerate importance of air to both plants and animals

APPENDIX B
Chemistry Academic Performance Test (CAPT)

Section A:

Gender: Male [ ] Female [ ]
Age_____

Name of School;

_____

_____

Section B:
Instruction: Each question is followed by four options lettered A-D. Identify the correct option, and circle the correct option, on the question paper.

(1) Combustion is a chemical reaction which is always accompanied by
A. Heat
B. Heat and light
C. Heat and energy
D. Heat and powder

(2) All these are the cause of luminously in flames except
A. Solid particles
B. Solid particles and increased temperature
C. Solid particles and increased pressure
D. The size of material burnt.

(3) These gases burn with blue flame except
A. H
B. CH_4
C. C_2H_3
D. He

(4) Which of these is necessary for metallic corrosion
A. Water
B. Oxygen
C. Heat
D. Sulphur (IV) Oxide

(5) What chemical process is represented by the following equation $4Fe_{[s]} + 3O_{2(g)}$ $2xH_2O_{(l)} \rightarrow 2Fe_2O_3.xH_2O$
A.Rusting
B. Oxidation
C. Hydration
D.Combustion

(6)The most abundant Noble Gas in nature is
A. Neon
B. Radom
C. Argon
D. Helium

(7) The following are major gaseous pollutant except
A. Oxides of Carbone. CO.
B. Carbon (IV) oxides
C. Chlorofluorocarbon
D. Oxides of sulphuregSO_2

(8) A diminish in ozone layer means an increase in the level of ultraviolet radiation that reaches earth. This can cause the following danger to humans except
A. Increase in cataract
B. skin cancer
C. Sunburn
D. High blood pressure

(9) The following are main air pollutant except
A. Flourine.
B. Oxides of Carbon
C. Oxides of Sulphur and Nitrogen
D. Particulate of matter

(10) Which of the following activities is not contributing to air pollution
A. Burning of wood
B. Burning of candle
C. Burning of plastics
D. Cutting of trees

(11) Air is a mixture of gases composed mainly of _____ and _____
A. Nitrogen and oxygen
B. Oxygen and hydrogen
C. Hydrogen and nitrogen
D. Nitrogen and argon

(12)Noble gases that are used to produced colored light are
A. Argon and helium
B. Crypton and argon
C. Neon and radon
D. Helium and neon

(13) What chemical process is presented by the following reaction:
$C_6H_{12}O_6(s) + 6O_{2(g)} \rightarrow 6HCO_{2(l)} + 6CO_{2(g)} + Energy$
Glucose Oxygen Water Carbon (IV) oxide
A. Rusting
B. Combustion
C. Photosynthesis
D. Respiration.

(14) The corrosion of metals results from the combined action of _____ and _____
A. Hydrogen and water
B. Carbon and nitrogen
C. Atmospheric oxygen and water
D. Atmospheric nitrogen and carbon

(15) A flames can be described as a region where gas combine chemically in the production of heat and
A. Oxygen
B. Light
C. Temperature
D. Smoke'

(16) During combustion the combustible material usually combines with atmospheric oxygen to form
A. Oxides and other products
B. Halides and chlorides
C. Sulphate and light
D. Gaseous compounds.

(17) All natural water contain dissolved air because their surface are exposed to
A. Light
B. Air
C. Sun
D. Atmosphere

(18) Change in the air where it is made impure is known as
A. Wind pollution
B. Atmospheric pollution
C. Air pollution
D. Global warming.

(19) Lead dust can cause lead poisoning injury to the
A. Lung
B. Liver
C. Heart
D. Nervous system

(20) Smog reduces visibility and causes
A. Blindness
B. Respiration disease
C. Lead poisoning
D. Vomiting.

APPENDIX C

Answers to Chemistry Academic Performance Test (CAPT)

(1) B
(2) D
(3) C
(4) A
(5) A
(6) C
(7) B
(8) D
(9) A
(10) D
(11) A
(12) B
(13) D
(14) C
(15) B
(16) A
(17) D
(18) C
(19) D
(20) B

APPENDIX D

Chemistry Motivation Scale (CMS) for Video Based Cooperative Learning Instructional Package (VBCLIP) Group

Interest inventory
Gender:_____
School:_____
Instruction:

This motivation scale is designed to help you indicate the degree of your motivation in chemistry as a result of teaching chemistry through a video-based cooperative learning educational package (VBCLIP). Do not worry if you do not know any of the activities or aspects mentioned in this document. Indicate your level of motivation in chemistry by checking (√) the appropriate options listed below:

SA- if you totally agree with the statement
A- if you agree with the statement
D- if you do not agree with the statement
SD- if you strongly disagree with the statement
Now complete the following

S/No	**Impact of Video Based Cooperative Learning Instructional Learning on your Motivation to Study Chemistry**	SA	A	D	SD
1	I am willing to read Chemistry books at my free time				
2	I prefer to spend my extra money on Chemistry books.				
3	I would readily pay for extra lessons on Chemistry.				
4	I enjoy drawing structures in Chemistry.				
5	I enjoy writing chemical equations in Chemistry.				
6	Going to Chemistry laboratory for learning activities is boring.				
7	I will accept take home assignments in Chemistry.				
8	I enjoy discussing topics in Chemistry with my fellow students.				
9	I am willing to study Chemistry beyond school certificate level.				
10	I will be a Chemistry teacher after graduation.				
11	I enjoy studying chemistry through video				
12	I will to help produce resources for teaching Chemistry.				
13	I feel happy in a Chemistry class.				
14	I would accept to work in the chemical industry.				
15	I will accept extra assignments from my Chemistry teacher.				

16	I am willing to contribute books for a Chemistry library.				
17	I wish to have more lesson periods allotted to Chemistry per week.				
18	I enjoy using my knowledge of Chemistry to solve problems at home.				
19	I am willing to teach my colleagues Chemistry.				
20	I would encourage friends and relatives to study Chemistry.				
21	I enjoy participating in Chemistry group work.				
22	I wish to know more about chemistry in the future.				
23	Using symbols and formulae is no longer boring to me.				
24	I wish to know more about components of substances around me.				
25	I will like to visit chemical industries.				
26	I would enjoy being able to extract chemicals from plants in the future				
27	I would spend my time visiting resource persons, to learn more about Chemistry.				
28	Knowing more about applications of Chemistry to solve personal problem is now my concern.				
29	I am willing to study chemistry related course in my higher education				
30	I wish to be a Chemistry laboratory prefect.				

Adapted from Vallerand et. al. (1992)

APPENDIX E

Chemistry Motivation Scale (CMS) for Facebook Based Cooperative Learning Instructional Package (FBCLIP) Group

Interest inventory
Gender:_____
School:_____
Instruction:

This motivation scale is designed to help you indicate the degree of your motivation in chemistry as a result of teaching chemistry through the Facebook Based Cooperative Learning Education Package (FBCLIP). Do not worry if you do not know any of the activities or aspects mentioned in this document. Indicate your level of motivation in chemistry by checking (√) the appropriate options listed below:

SA- if you totally agree with the statement
A- if you agree with the statement
D- if you do not agree with the statement
SD- if you strongly disagree with the statement
Now complete the following

S/No	**Impact of Facebook Based Cooperative Learning Package on your Motivation to Study Chemistry**	SA	A	D	SD
1	I am willing to read Chemistry books at my free time				
2	I prefer to spend my extra money on Chemistry books.				
3	I would readily pay for extra lessons on Chemistry.				
4	I enjoy drawing structures in Chemistry.				
5	I enjoy writing chemical equations in Chemistry.				
6	Going to Chemistry laboratory for learning activities is boring.				
7	I will accept take home assignments in Chemistry.				
8	I enjoy discussing topics in Chemistry with my fellow students.				
9	I am willing to study Chemistry beyond school certificate level.				
10	I will be a Chemistry teacher after graduation.				
11	I enjoy studying chemistry through Facebook				
12	I will to help produce resources for teaching Chemistry.				
13	I feel happy in a Chemistry class.				
14	I would accept to work in the chemical industry.				
15	I will accept extra assignments from my Chemistry teacher.				
16	I am willing to contribute books for a Chemistry library.				

17	I wish to have more lesson periods allotted to Chemistry per week.				
18	I enjoy using my knowledge of Chemistry to solve problems at home.				
19	I am willing to teach my colleagues Chemistry.				
20	I would encourage friends and relatives to study Chemistry.				
21	I enjoy participating in Chemistry group work.				
22	I wish to know more about chemistry in the future.				
23	Using symbols and formulae is no longer boring to me.				
24	I wish to know more about components of substances around me.				
25	I will like to visit chemical industries.				
26	I would enjoy being able to extract chemicals from plants in the future				
27	I would spend my time visiting resource persons, to learn more about Chemistry.				
28	Knowing more about applications of Chemistry to solve personal problem is now my concern.				
29	I am willing to study chemistry related course in my higher education				
30	I wish to be a Chemistry laboratory prefect.				

Adapted from Vallerand et. al. (1992

APPENDIX F

Chemistry Motivation Scale (CMS) For WhatsApp Based Cooperative Learning Instructional Package (WBCLIP) Group

Interest inventory

Gender:_____

School:_____

Instruction:

This motivation scale is designed to help you indicate the degree of your motivation in chemistry as a result of teaching chemistry through the WhatsApp Based Cooperative Learning Education Package (WBCLIP). Do not worry if you do not know any of the activities or aspects mentioned in this document. Indicate your level of motivation in chemistry by checking (√) the appropriate options listed below:

SA- if you totally agree with the statement

A- if you agree with the statement

D- if you do not agree with the statement

SD- if you strongly disagree with the statement Now complete the following

S/No	Impact of WhatsApp Based Cooperative Learning Package on your Motivation to Study Chemistry	SA	A	D	SD
1	I am willing to read Chemistry books at my free time				
2	I prefer to spend my extra money on Chemistry books.				
3	I would readily pay for extra lessons on Chemistry.				
4	I enjoy drawing structures in Chemistry.				
5	I enjoy writing chemical equations in Chemistry.				
6	Going to Chemistry laboratory for learning activities is boring.				
7	I will accept take home assignments in Chemistry.				
8	I enjoy discussing topics in Chemistry with my fellow students.				
9	I am willing to study Chemistry beyond school certificate level.				
10	I will be a Chemistry teacher after graduation.				
11	I enjoy studying chemistry through WhatsApp				
12	I will to help produce resources for teaching Chemistry.				
13	I feel happy in a Chemistry class.				
14	I would accept to work in the chemical industry.				
15	I will accept extra assignments from my Chemistry teacher.				
16	I am willing to contribute books for a Chemistry library.				
17	I wish to have more lesson periods allotted to Chemistry				

	per week.				
18	I enjoy using my knowledge of Chemistry to solve problems at home.				
19	I am willing to teach my colleagues Chemistry.				
20	I would encourage friends and relatives to study Chemistry.				
21	I enjoy participating in Chemistry group work.				
22	I wish to know more about chemistry in the future.				
23	Using symbols and formulae is no longer boring to me.				
24	I wish to know more about components of substances around me.				
25	I will like to visit chemical industries.				
26	I would enjoy being able to extract chemicals from plants in the future				
27	I would spend my time visiting resource persons, to learn more about Chemistry.				
28	Knowing more about applications of Chemistry to solve personal problem is now my concern.				
29	I am willing to study chemistry related course in my higher education				
30	I wish to be a Chemistry laboratory prefect.				

Adapted from Vallerand et. al. (1992)

APPENDIX G
SPSS OUTPUT

Frequencies

Statistics

		GROUPS	Age of Respondents
N	Valid	120	120
	Missing	0	0

GROUPS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Video_based	40	33.3	33.3	33.3
	Facebook	40	33.3	33.3	66.7
	Whatsapp	40	33.3	33.3	100.0
	Total	120	100.0	100.0	

Age of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	12-14	15	12.5	12.5	12.5
	15-17	92	76.7	76.7	89.2
	18 and above	13	10.8	10.8	100.0
	Total	120	100.0	100.0	

GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	72	60.0	60.0	60.0
	Female	48	40.0	40.0	100.0
	Total	120	100.0	100.0	

Hypothesis one:
Oneway

Descriptive

Chemistry Achievement

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Video_based	43	50.7209	17.79423	2.71359	45.2447	56.1972
Facebook	40	48.0500	15.48523	2.44843	43.0976	53.0024
Whatsapp	40	49.9250	13.59560	2.14965	45.5769	54.2731
Total	123	49.5935	15.68482	1.41425	46.7938	52.3932

Descriptives

Chemistry Achievement

	Minimum	Maximum
Video_based	15.00	85.00
Facebook	18.00	79.00
Whatsapp	20.00	77.00
Total	15.00	85.00

ANOVA

Chemistry Achievement

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	154.349	2	77.174	.310	.734
Within Groups	29859.326	120	248.828		
Total	30013.675	122			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Chemistry Achievement

Scheffe

(I) GROUPS	(J) GROUPS	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Video_based	Facebook	2.67093	3.46517	.744	-5.9179	11.2598
	Whatsapp	.79593	3.46517	.974	-7.7929	9.3848
Facebook	Video_based	-2.67093	3.46517	.744	-11.2598	5.9179
	Whatsapp	-1.87500	3.52723	.868	-10.6177	6.8677
Whatsapp	Video_based	-.79593	3.46517	.974	-9.3848	7.7929
	Facebook	1.87500	3.52723	.868	-6.8677	10.6177

Homogeneous Subsets

Chemistry Achievement

Scheffe

GROUPS	N	Subset for alpha = 0.05
		1
Facebook	40	48.0500
Whatsapp	40	49.9250
Video_based	43	50.7209
Sig.		.746

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 40.952.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Hypothesis two:

```
ONEWAY Chemistry_Motivation BY GROUPS
  /STATISTICS DESCRIPTIVES
  /MISSING ANALYSIS
  /POSTHOC=SCHEFFE ALPHA(0.05).
```

Oneway

Descriptive

Chemistry Motivation

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Video_based	43	80.1395	13.98057	2.13202	75.8370	84.4421
Facebook	40	87.1000	13.10862	2.07265	82.9077	91.2923
Whatsapp	40	87.0750	11.02535	1.74326	83.5489	90.6011
Total	123	84.6585	13.12039	1.18303	82.3166	87.0005

Descriptive

Chemistry Motivation

	Minimum	Maximum
Video_based	56.00	103.00
Facebook	50.00	106.00
Whatsapp	64.00	103.00
Total	50.00	106.00

ANOVA

Chemistry Motivation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1350.121	2	675.060	4.122	.019
Within Groups	19651.538	120	163.763		
Total	21001.659	122			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Chemistry Motivation

Scheffe

(I) GROUPS	(J) GROUPS	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Video_based	Facebook	-6.96047	2.81114	.050	-13.9282	.0073
	Whatsapp	-6.93547	2.81114	.051	-13.9032	.0323
Facebook	Video_based	6.96047	2.81114	.050	-.0073	13.9282
	Whatsapp	.02500	2.86149	1.000	-7.0676	7.1176
Whatsapp	Video_based	6.93547	2.81114	.051	-.0323	13.9032
	Facebook	-.02500	2.86149	1.000	-7.1176	7.0676

Homogeneous Subsets

Chemistry Motivation

Scheffe

GROUPS	N	Subset for alpha = 0.05
		1
Video_based	43	80.1395
Whatsapp	40	87.0750
Facebook	40	87.1000
Sig.		.052

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 40.952.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

```
ONEWAY Post_test_Achievement BY GROUPS
  /STATISTICS DESCRIPTIVES
  /MISSING ANALYSIS
  /POSTHOC=SCHEFFE ALPHA(0.05).
```

Hypothesis three:

```
T-TEST GROUPS=GENDER('1' '2')
  /MISSING=ANALYSIS
  /VARIABLES=Post_test_Achievement
  /CRITERIA=CI(.95).
```

T-Test

Group Statistics

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
Chemistry Achievement	Male	74	48.2973	15.79815	1.83650
	Female	49	51.5510	15.46644	2.20949

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Chemistry Achievement	Equal variances assumed	.000	.984	-1.128	121	.262	-3.25372	2.88560	-8.96652	2.45908
	Equal variances not assumed			-1.132	104.452	.260	-3.25372	2.87308	-8.95086	2.44341

Hypothesis Four:

```
T-TEST GROUPS=GENDER('1' '2')
  /MISSING=ANALYSIS
  /VARIABLES=Chemistry_Motivation
  /CRITERIA=CI(.95).
```

T-Test

Group Statistics

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
Chemistry Motivation	Male	74	84.6351	14.18621	1.64911
	Female	49	84.6939	11.46590	1.63799

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Chemistry Motivation	Equal variances assumed	2.872	.093	-.024	121	.981	-.05874	2.42645	-4.86254	4.74506
	Equal variances not assumed			-.025	116.154	.980	-.05874	2.32434	-4.66233	4.54485

DATA

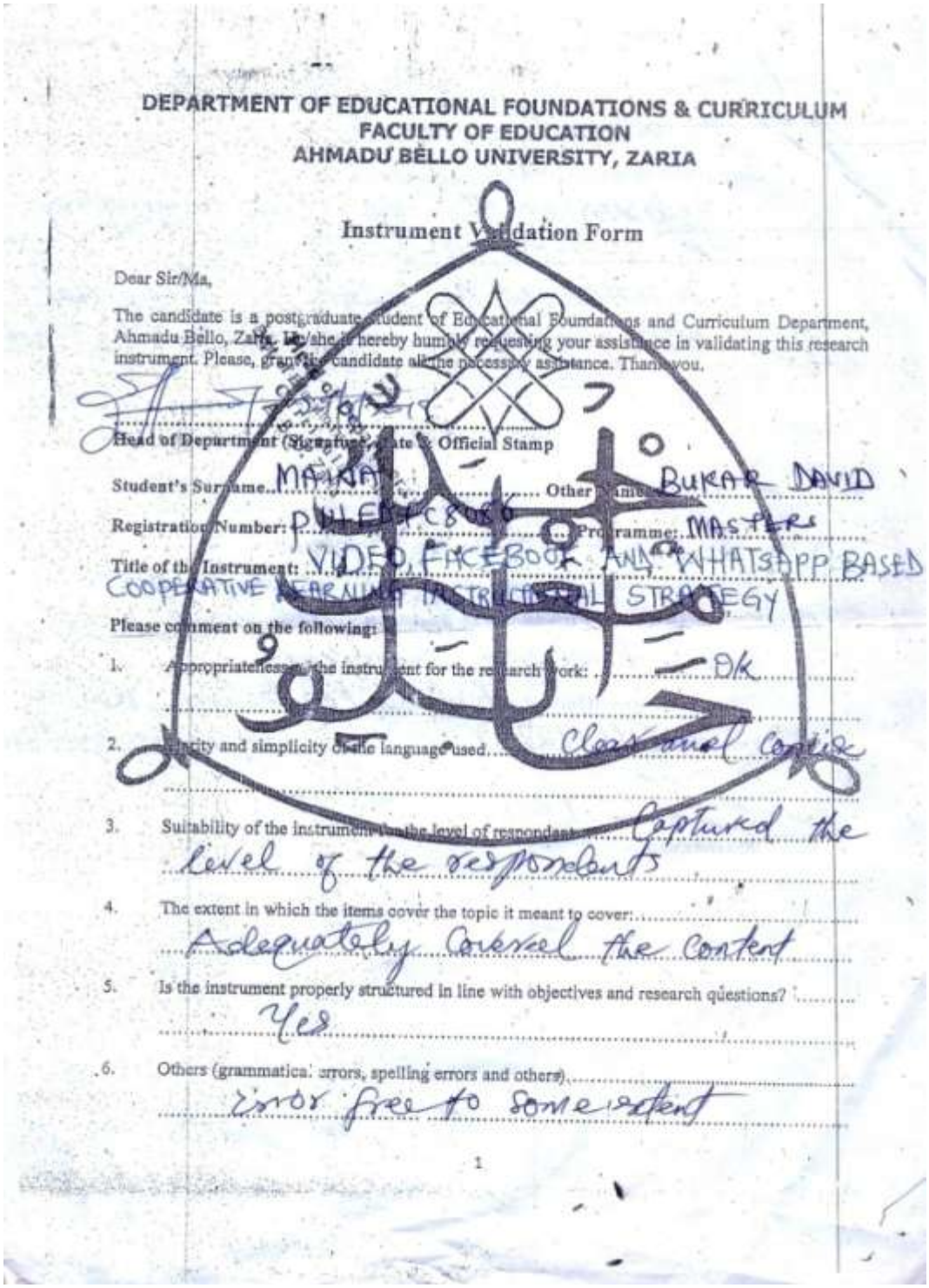
Gender	Age	Groups	CAT	CMS
Male	15-17	Whatsapp	45	102
Male	15-17	Whatsapp	50	89
Female	15-17	Whatsapp	58	96
Male	12-14	Whatsapp	32	92
Female	12-14	Whatsapp	55	99
Male	15-17	Whatsapp	48	70
Male	15-17	Whatsapp	62	80
Female	15-17	Whatsapp	69	79
Male	15-17	Whatsapp	46	100
Male	15-17	Whatsapp	25	69
Male	15-17	Whatsapp	77	68
Female	12-14	Whatsapp	61	64
Female	15-17	Whatsapp	53	99
Male	15-17	Whatsapp	52	88
Female	12-14	Whatsapp	39	67
Male	15-17	Whatsapp	64	100
Male	15-17	Whatsapp	54	89
Female	15-17	Whatsapp	30	92
Male	15-17	Whatsapp	28	98
Male	15-17	Whatsapp	20	99
Female	15-17	Whatsapp	56	80
Male	15-17	Whatsapp	50	79
Female	15-17	Whatsapp	54	70
Male	12-14	Whatsapp	47	98
Female	15-17	Whatsapp	60	100
Male	15-17	Whatsapp	41	99
Female	15-17	Whatsapp	58	92
Female	15-17	Whatsapp	39	81
Male	18 and above	Whatsapp	33	83
Female	15-17	Whatsapp	57	87
Male	15-17	Whatsapp	53	89
Male	15-17	Whatsapp	66	77
Male	15-17	Whatsapp	70	86
Female	15-17	Whatsapp	26	85
Male	12-14	Whatsapp	39	82
Female	15-17	Whatsapp	44	83
Male	15-17	Whatsapp	52	103
Male	18 and above	Whatsapp	58	98
Male	15-17	Whatsapp	57	89
Female	15-17	Whatsapp	69	82

Male	15-17	Video_based	37	70
Male	15-17	Video_based	50	70
Female	15-17	Video_based	58	65
Male	15-17	Video_based	62	62
Female	15-17	Video_based	54	67
Male	15-17	Video_based	46	69
Female	15-17	Video_based	44	70
Male	15-17	Video_based	60	93
Male	12-14	Video_based	36	58
Male	15-17	Video_based	67	56
Female	15-17	Video_based	52	88
Male	15-17	Video_based	45	63
Female	15-17	Video_based	25	79
Male	12-14	Video_based	37	80
Male	15-17	Video_based	68	67
Female	15-17	Video_based	62	69
Male	15-17	Video_based	18	57
Female	18 and above	Video_based	39	82
Male	15-17	Video_based	21	84
Female	15-17	Video_based	68	68
Female	15-17	Video_based	32	98
Male	15-17	Video_based	70	78
Male	15-17	Video_based	15	88
Male	15-17	Video_based	29	67
Female	15-17	Video_based	40	100
Male	15-17	Video_based	49	98
Male	15-17	Video_based	71	102
Female	15-17	Video_based	85	68
Male	15-17	Video_based	72	91
Female	18 and above	Video_based	64	90
Male	18 and above	Video_based	30	83
Female	15-17	Video_based	54	80
Male	15-17	Video_based	79	65
Female	15-17	Video_based	58	88
Male	15-17	Video_based	36	79
Male	15-17	Video_based	85	96
Female	15-17	Video_based	71	100
Female	15-17	Video_based	44	98
Male	15-17	Video_based	37	100
Male	15-17	Video_based	37	79
Male	15-17	Video_based	60	103
Female	15-17	Video_based	64	89
Male	12-14	Video_based	50	89

Male	15-17	Facebook	38	84
Female	15-17	Facebook	60	80
Male	12-14	Facebook	55	98
Female	15-17	Facebook	50	90
Male	15-17	Facebook	51	89
Female	18 and above	Facebook	39	99
Female	15-17	Facebook	37	94
Male	15-17	Facebook	25	91
Male	15-17	Facebook	48	71
Male	18 and above	Facebook	41	98
Female	15-17	Facebook	70	78
Male	15-17	Facebook	62	106
Male	15-17	Facebook	37	102
Female	12-14	Facebook	79	102
Male	12-14	Facebook	29	98
Male	15-17	Facebook	52	99
Female	18 and above	Facebook	64	99
Female	15-17	Facebook	18	98
Male	15-17	Facebook	38	100
Female	15-17	Facebook	29	98
Male	15-17	Facebook	67	98
Female	15-17	Facebook	62	79
Male	12-14	Facebook	44	98
Male	15-17	Facebook	50	89
Female	15-17	Facebook	33	87
Male	18 and above	Facebook	56	76
Female	18 and above	Facebook	48	74
Male	15-17	Facebook	21	98
Male	15-17	Facebook	66	50
Male	18 and above	Facebook	57	100
Female	18 and above	Facebook	55	70
Male	15-17	Facebook	62	85
Female	15-17	Facebook	27	90
Male	12-14	Facebook	44	80
Female	15-17	Facebook	36	79
Male	12-14	Facebook	25	81
Female	15-17	Facebook	77	78
Male	15-17	Facebook	61	59
Male	15-17	Facebook	59	66
Male	18 and above	Facebook	50	73

APPENDIX H

Validation of Video, Facebook and Whatsapp Based Instructional Package (Lesson Plan)



DEPARTMENT OF EDUCATIONAL FOUNDATIONS & CURRICULUM
FACULTY OF EDUCATION
AHMADU BELLO UNIVERSITY, ZARIA

Instrument Validation Form

Dear Sir/Ma,

The candidate is a postgraduate student of Educational Foundations and Curriculum Department, Ahmadu Bello, Zaria. He/she is hereby humbly requesting your assistance in validating this research instrument. Please, grant the candidate all the necessary assistance. Thankyou.

Head of Department (Signature, Date & Official Stamp

Student's Surname: MAINA Other Names: BUKAR DAVID

Registration Number: PHEF/C8046 Programme: MASTERS

Title of the Instrument: VIDEO, FACEBOOK AND WHATSAPP BASED COOPERATIVE LEARNING INSTRUCTIONAL STRATEGY

Please comment on the following:

1. Appropriateness of the instrument for the research work: Ok
2. Clarity and simplicity of the language used: Clear and concise
3. Suitability of the instrument to the level of respondent: Captured the level of the respondents
4. The extent in which the items cover the topic it meant to cover: Adequately Covered the content
5. Is the instrument properly structured in line with objectives and research questions? Yes
6. Others (grammatical errors, spelling errors and others): Error free to some extent

1

7. General comment on the instrument: The instruments are adequate

Suggestion(s) for improving the quality of the instrument

1. Redesign on the age item to grouping eg 14-17-(a), 18-21-(b) etc
2. Mention all the schools on Study, that will give easier selection by the respondents
3. .....
4. .....

ATTESTATION SECTION

I hereby testify that the above named student brought his/her instrument for validation

Name of Attester: Shehu Othman Abdullahi

Designation: Principal Lecturer

Name and Address of Institution: Kaduna Polytechnic, Kaduna

Phone No: 08166172728 **E-mail:** shehuothman2000@gmail.com

9/5/19

Signature and Date

Thank You

APPENDIX I

Latter of Request for Population of SSII Students in Kaduna Metropolis

Faculty Of Education,
Department Of Educational
Foundation and Curriculum,
Instructional Technology Section,
Ahmadu Bello University Zaria.
10/9/2018.

The Honourable Commissioner,
Ministry of Science and Technology,
Kaduna State.

HON. COMMISSIONER
MINISTRY OF EDUCATION SCIENCE AND TECHNOLOGY
RECEIVED
11 SEP 2018
KADUNA STATE

Through

The Director,
Zonal Quality Assurance,
Kaduna.

Dear Sir/Madam

REQUEST FOR THE TOTAL POPULATION OF SSII STUDENTS IN KADUNA NORTH L.G.A

I am a masters student in the above named institution carrying out a research on the topic **"impact of technology integration in cooperative learning on students' achievement, retention and motivation in Kaduna state"** as part of requirement for the award of master's degree in instructional technology of the above university.

For the purpose of this research, I selected government secondary schools in Kaduna North local government area as my study population. As a mandatory requirement, i am directed by my department to obtain data regarding the number of schools as well as the population of all SSII students in Kaduna North local government area. This information will be used solely for the purpose of this research work.

I will be very grateful if my request is given due consideration. Thank you very much.

Yours Faithfully,

Maina Bukar David

P14EDFC8086

PHONE; 08133320383

Table 3.15: Public and private senior secondary school enrolment by gender and LGA

LGA	Public				Private			
	Number of Schools	Pupils	Girls	% girls	Number of Schools	Pupils	Girls	% girls
BIRNIN GWARI	7	1,550	271	17	2	225	109	48
CHIKUN	17	6,958	3,338	48	66	8,349	4,135	50
GIWA	9	2,091	760	36	6	1,255	509	41
IGABI	15	5,852	1,704	29	19	1,261	591	47
IKARA	10	2,218	468	21	0	42	10	24
JABA	9	2,111	1,006	48	3	588	410	70
JEMA'A	12	4,426	1,892	43	9	1,121	540	48
KACHIA	25	5,342	2,300	43	5	172	75	44
KADUNA NORTH	13	9,039	5,697	63	41	4,188	2,080	50
KADUNA SOUTH	12	7,977	5,236	66	84	10,180	5,168	51
KAGARKO	15	5,333	2,218	42	11	442	173	39
KAJURU	11	4,348	2,106	48	2	357	184	52
KAURA	11	2,171	771	36	1	44	20	45
KAURU	10	8,667	1,551	18	2	161	65	40
KUBAU	9	2,806	1,090	39	4	581	216	37
KUDAN	4	1,649	347	21	-	-	-	0
LERE	16	5,432	2,040	38	8	1,105	620	56
MAKARFI	6	2,445	482	20	2	199	77	39
SABON GARI	10	6,520	3,149	48	37	3,886	1,975	51
SANGA	12	4,854	2,207	45	0	-	-	0
SOBA	7	1,359	196	14	0	-	-	0
ZANGON KATAF	33	5,812	2,960	51	4	603	288	48
ZARIA	12	10,425	4,424	42	35	6,329	3,168	50
TOTAL	**285**	**109,385**	**46,213**	**42**	**341**	**41,088**	**20,413**	**50**

This table shows the number of schools, total number of pupils and Girl -child enrolment rate in Public and Private Senior Secondary Schools

There is a total enrolment of 109,385 out of which 46,213 are girls in public Senior Secondary school. The Private Sector accounts for an enrolment of 41,088 out which 20,413 are girls in Senior Secondary schools

Table 3.16: Public and Private Senior secondary school enrolment by gender and LGA

LGA	Total			Aged 15-17		
	Pupils	Girls	% Girls	Pupils	Girls	% Girls
BIRNIN GWARI	1,775	380	21	1,521	260	17
CHIKUN	15,307	7,473	49	10,808	5218	48
GIWA	3,346	1,269	38	2,637	1081	41
IGABI	7,113	2,295	32	4,834	1719	36
IKARA	2,260	478	21	1,986	369	19
JABA	2,699	1,416	52	2,724	1338	49
JEMA'A	5,547	2,432	44	3,943	1756	45
KACHIA	5,514	2,375	43	3,560	1549	44
KADUNA NORTH	13,227	7,777	59	8,608	5067	59
KADUNA SOUTH	18,157	10,404	57	13,594	7842	58
KAGARKO	5,775	2,391	41	4,290	1743	41
KAJURU	4,705	2,290	49	3,856	1575	41
KAURA	2,215	791	36	1,782	638	36
KAURU	8,828	1,616	18	4,232	1369	32
KUBAU	3,387	1,306	39	2,228	926	42
KUDAN	1,649	347	21	748	165	22
LERE	6,537	2,660	41	4,507	1901	42
MAKARFI	2,644	559	21	2,030	470	23
SABON GARI	10,406	5,124	49	7,381	3881	53
SANGA	4,854	2,207	45	3,673	1662	45
SOBA	1,359	196	14	2,039	613	30
ZANGON KATAF	6,415	3,248	51	4,449	2126	48
ZARIA	16,754	7,592	45	11,826	5160	44
TOTAL	**150,473**	**66,626**	**44**	**107,256**	**48,428**	**45**

The total number of Pupils in Public and Private Senior Secondary school irrespective of sex and age is 150,473 out of which 66,626 are girls.