# EFFECT OF MASTERING LEARNING APPROACH ON SENIOR SECONDARY SCHOOL STUDENTS`ACHIEVEMENT AND MOTIVATION IN CHEMISTRY IN CHANCHAGA LOCAL GOVERNMENT AREA OF NIGER STATE

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**A PROJECT SUMMITED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF BACHELOR OF TECHNOLOGY (B. TECH) IN CHEMISTRY EDUCATION DEPARTMENT OF SCIENCE EDUCATION SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION FEDERAL UNIVERSITY OF TECHNOLOGY MINA, NIGER STATE**

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## ABSTRACT

The research work investigating impact of mastering learning approach on senior secondary school students achievement in chemistry in chanchaga local Government Area of Niger state. Three research questions were raised to guide the study while three null hypotheses were tested 0.05 levels of significant. Quasi experimental research design was use and the population of the study was 5,170 SS2 chemistry students from all the secondary school in chanchaga local government area of Niger State. The sample of the study was 160 SS2Chemistry Students was captured from the inter classes of co-educational public school in chanchaga local government area of Niger state, four schools were randomly assigned as two experimental group and the other control group, the experimental group has a total number of 75 students were taught chemistry concept with mastering learning approach while the control group has a total number of 85 chemistry student were taught chemistry without the use of Mastering Learning Approach, the instrument use for data collection was students motivation questionnaire (SMQ) and Chemistry Achievement Test (CAT)). The chemistry achievement test which compromises of 15 multiple choice questions with four option and one right answer, two senior lecturers in science education validated the content of the instruments, Cronbach's Alpha techniques was used to administer 30 questions to 30 students for the pilot study, after the first treatment, chemistry achievement test was administer to the students under supervision of the chemistry teachers and also student motivation questionnaire was administer , the questionnaire was collected, the data collected were analyzed using statistical package for social science (SPSS) for imputing the data for descriptive statistics frequency table bar graph and mean standard deviation and T-test. The findings reveal that there is a significant difference between the experimental and control group, there is no significant difference in the achievement scores of male and female students taught Chemistry concepts using mastery approach. it is recommended that School management and administrators should improve instructional approach used in teaching and learning chemistry for example the 21$^{st}$ century learning students centred approaches to chemistry teachers to use in chemistry lessons, Chemistry teachers should be enlightened on the importance of utilizing mastery learning approach in teaching chemistry.

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# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background of the Study

Science subjects constitute a major part of the subjects being offered in secondary schools in Nigeria today. These subjects are so important that the Federal Government National Policy on Education (2008) stated in specific terms that "the secondary schools' education shall provide trained manpower in the applied science and technology. The National Policy on Education (2008) further stated that science subjects constitute part of the core subjects at both junior and secondary school levels. The importance attached to science by the Federal Government could be due to the general belief that science is capable of improving and changing skills, attitudes, knowledge about themselves, their environment and their world. (Nnorom, N.R. & Obi, Z, 2013). It is often regarded as the "QUEEN or MOTHER OF THE SCIENCES" due to its relevance as a pre-requisite subject in the study of both pure and applied sciences courses at tertiary level of education. (Anusiem, 2014) described chemistry as knowledge which relates to everyday needs and is encountered in every field of science for solving human problems. Thus, apart from its requirement in the study of pure science and science-related courses, chemistry plays vital roles in solving human problems through the provision of human needs. Therefore, the relevance of chemistry in scientific and technological development of a nation and in the life of individuals cannot be underrated. Nonetheless, the quantity and quality of science educators and technologists, doctors, pharmacists, agriculturists, engineers, chemists etc in a given nation serves as the pointer of the level of scientific and technological growth and advancement of that

nation, and the availability of these manpower depend mostly on the quality of science education they received, as well as their academic attainment or achievement. Students' academic achievement in science is one of the indices for measuring the quality of science teaching and learning. Poor students' academic achievement in chemistry has been reported (Betiku, 2019); (West African Examination Council); (Ajewale, 2015); (Ezeliora, 2014); (Olatayo RA, fuwape, 2014). Perhaps, this could be attributed to a number of factors not excluding the teacher related factors such as poor teacher preparation, incompetent teachers, and poor teaching methods that seems to be mostly implicated. Teaching methods often used in teaching science subjects especially chemistry are mostly teacher-centered. One of these strategies is direct Instruction (DI). It is regarded as the basic, conventional and mostly used teacher-centered teaching strategy that describes teaching as lecture and teacher-led demonstrations (Kinder D, Kubina, R, Marchand-martella N., 2018). Direct Instruction otherwise known as lecture or talk and chalk teaching method has been condemned for not considering learners individual differences in terms of learning rates. To(Adeyemo SA, Babajide VFT, 2014) direct Instruction does not contribute in learners achieving scientific and technological literacy nor gain of practical knowledge as it neither motivate nor promote students to actively participate in the learning process due to its teach er- centeredness. Hence this study is targeted at investigating the impacts of mastery learning strategy (MLS) on chemistry students' self-esteem and academic achievement.

In spite of the importance and popularity of Chemistry among Nigerian students, performance at senior secondary school level has been poor (Ahmed, 2008). Indicators from examinations such as those organized by the West African Examinations Council (WAEC) and the National Examinations Council (NECO) showed poor performance in Chemistry (WAEC, 2016). The number of students that passed Chemistry at credit level (A1-C6) is observed to be consistently

less than 50% (28% - 49%) for many years. This low level of achievement is also reported by (Eze, A.E., & Egbo, J.J. , 2011). A major implication of this failure is that Nigeria may have shortages of manpower in science and health-related disciplines. (Ikpe, 2011) stated that the noble intention of science education may not be realized if no pragmatic strategies are employed. According to(Omale, M.O., 2016), Nigerian schools may end up producing a large number of illiterate science graduates unless the factors contributing to these high failure rates in science subjects are identified and properly taken care of. Several factors have been advanced as affecting students' achievement. These include student factors, teacher factors, societal factors, governmental infrastructural factors, language factor, and instructional strategies employed by the teachers. (Otor, E.E. , 2012) linked it to declining standards of teaching; others have attributed the poor achievement of students in science subjects to mismatch between students' reasoning level and science content demand (Gyuse, E.Y., 2006);(Achor., 2017); Ikpe, 2011), and unsuitable instructional approaches (Olayiwola, M.A, 2009).It is in the light of this that some educationists, Olarewaju (2012), and (Samba, R.M.O. , 2012), have advocated a re-examination of instructional approaches to teaching of science subjects in educational institutions. This kind of re-examination is vital today in the teaching of chemistry in particular and science in general, especially as Nigeria needs competent scientists to harness the country's natural resources. This is only attainable when appropriate teaching and learning strategies are adopted particularly at the secondary school level. Several innovative approaches to enhance learning include Concept Mapping instructional strategy (Samba, 2012; Otor, 2012), Inquiry approach (Ogbeba, J.A , 2012), Conceptual Change (Achor, 2012), and Vee Mapping (Apochi, M.A , 2012).

Lecture method is the prevailing method of disseminating knowledge at virtually all levels of academics in Nigeria. It is the traditional method, the talk and chalk as well as conventional

method of teaching. The teacher does the bulk of the talking as he presents large body of facts and principles to many students in a teacher- centered mode.

This instructional method is mainly authoritarian in nature. Lecture method provides careful, lucid presentation of materials (Olarewaju, 2012). However, in a haste to cover the syllabus expediently, teachers do not pay attention to whether the students understand content or not. As a result, both interest and understanding of students may be lost. Studies on underachievement of students in secondary school subjects reported inefficient teaching methods by school teachers as a major factor for the underachievement of students (Okebukola, 2005; Olayiwola, 2007; Olarewaju 2012, Samba, 2012; and (Filgona, 2016).

According to Okebukola (2005), the conventional approach does not accommodate the natural diversity in learning abilities among different groups of students. It does not provide a flexible approach that accommodates all students according to their respective levels of learning and understanding. This type of learning strategy does not enhance students' achievement nor stimulate students to be more actively involved in the teaching learning process.

At the end of the teaching activities with one group, nearly all of the individuals of that group are expected to be successful. However, each student has individual learning abilities and the pace at which they learn that differ from other members of the group (Olarewaju 2012). In this case we encounter a problem which raises several questions such as: Do all students have the same characteristics to benefit from the same education through the same teacher, under the same conditions and environment? How do you cater for differences between students? When the answers to these questions and the number of the students at the school are considered, it can be concluded that individual differences should not be disregarded but be taken into consideration.

(Ekitde, G. A., & Edet, U. B. , 2013) indicated that more attention than ever was being focused on how to meet the challenges of increased diversity in the classroom. They argue that one of the most significant challenges instructors face is to be tolerant and perceptive enough to recognize learning differences among students. They further stress that the interest which students show in science subjects and the mastery they demonstrate on completion of a course of study largely depends on the teaching methods. One of the possible causes of Nigerian students' poor retention in sciences is inability of mastering scientific concepts. This has led to a growing concern that the nation's schools are unable to educate the youths and therefore, non-traditional approaches to instruction must be evaluated for possible adoption. To address these challenges, there is need for an instructional system that can help students learn, understand, and retain Chemistry concepts better. The search for improved strategies as an alternative to the conventional approach for teaching and learning of science is a continuous process. This research work therefore seeks to investigate the potentials of one of such non-traditional instructional approaches called Mastery Learning.

Mastery learning is an instructional approach based on the concept that all students can learn when provided with conditions appropriate to their situation. According to (David, D., & Sorrell, J. , 2016), in Mastery Learning Approach (MLA), students are allowed several opportunities to demonstrate mastery of content taught. The students are expected to reach a predetermined level of mastery on one unit before they are allowed to progress to the next. Students are given specific feedback about their learning progress at regular intervals throughout the instructional period. This feedback helps them identify what they have learned well and what they have not learned well. Areas that were not learned well are allotted more time to achieve mastery. Only grades of "A" and "B" are permitted because these are the accepted standards of mastery.

Although students taught for mastery may need more time to reach proficiency at the initial stages of a course, with time, they should need less time to master more advanced material because of the firm grasp of fundamentals that they should have gained from their initial efforts. Bloom maintains that besides mastery of the material to be learned, mastery learning increases the attitude, interest, and self esteem of students.

Bloom and his students have conducted many empirical studies that demonstrate the effectiveness of mastery programmes in a wide variety of circumstances (Wambugu, 2008). Mastery Learning Approach involves breaking down the subject matter to be learned into units of learning, each with its own objectives. The strategy allows students to study contents unit after unit until they master them. Mastery of each unit is shown when the student has acquired the set pass mark of a diagnostic test. MLA helps the student to acquire prerequisite skills to move to the next unit. MLA can help the teacher to know students area of weakness and correct it thus breaking the cycle of failure. Results from research studies carried out on MLA suggest that MLA yields better retention and transfer of material, yields greater interest and more positive attitudes in various subjects than non-mastery learning approaches (Ngesa, 2012); (Wachanga, S.W., & Gamba, P.P , 2015).

### 1.2. Statement of the Problem

Despite growing awareness of the importance of the sciences, especially chemistry, to the socio-economic and technological development of any nation, Nigerian students still perform dismally in both internal and external examinations. Lack of using inappropriate instructional strategies by teachers, ' characteristics among others. Rarely do teachers of chemistry use innovative teaching methods which have been proven effective.

Science classrooms are becoming more diverse with differences in terms of learning environment, students' background, students' interest, and abilities. Conventional approaches of teaching science such as the lecture method are not producing the desired results among students. Newer approaches such as guided discovery, cooperative learning, inquiry, and concept mapping, have been studied and found to be effective to varying degrees, in improving students' achievement and content retention, as well as in arousing students' interest.

Meanwhile, records from the West African Examinations Council (WAEC 2015-2019) show that results have remained poor. This is highly disturbing and is of great concern to the researcher, thereby necessitating this study. Low interest of students in chemistry has been traced to poor achievement in examinations which is also traceable to teaching approaches employed. Teaching is effective when the approach used brings about a desirable change in the behaviour of the learner. This means an improvement in achievement and retention of taught content as well as improved students' interest in the subject. If students' achievement, retention and interest have to improve, then the students have to be introduced to a more efficient and appropriate teaching approach such as the Mastery Learning Approach. Mastery Learning Approach is an innovative alternative instructional approach being explored by educators to determine its effectiveness on teaching and learning outcomes; but studies indicating its use in schools as well as its effect on academic achievement in Chemistry, content retention and interest in the study area are not sufficiently reported. Therefore one may ask; will the use of mastery learning approach have positive effects in improving students' achievement, retention and interest in Chemistry? There is the need to apply Mastery Learning Approach (MLA) to Chemistry students' learning and evaluate its effectiveness specifically with regards to achievement, retention of content and students' interest when compared with the use of the conventional approach, hence the need for

this study. Therefore, this research seeks to determine the impacts of Mastery Learning Approach on achievement and motivation among Senior Secondary School chemistry Students in Chanchaga, Niger State, Nigeria.

### 1.3. Aim and Objective of the study

The aim of this study is to investigate the impacts of mastery learning approach on senior secondary school students' achievement in chemistry.Specifically, the study sought to determine:

1. the effect of mastery learning strategy on chemistry students' achievement in secondary school Chemistry.
2. the effect of mastery learning approach on secondary school Chemistry students" motivation,.
3. if there is any difference in motivation of male and female students when taught using mastery learning approach

### 1.4. Research questions

The following research questions were raised to guide the study:

1. What is the difference between the mean scores of students taught using mastery learning approach and those taught using lecture method?
2. What is the difference between level of motivation between students taught using mastery learning approach and those taught using lecture method?
3. What is the difference between level of motivation of male and female students taught using mastery learning approach?

### 1.5 Research Hypotheses

1. **$HO_1$:** There is no significant difference between the students taught using mastery learning and those taught using lecture method
2. **$HO_2$:** There is no significant difference between level of motivation between students taught using mastery learning approach and those taught using lecture method
1. **$HO_2$:** There is no significant difference between level of motivation of male and female students taught using mastery learning approach

### 1.6. Scope of the Study

This study focused on investigating the impact of Mastery Learning Approach on senior secondary classes Chemistry students' achievement. The study also examined gender differences on achievement in chemistry. The geographical scope of this study was Chanchaga LGA of Niger State, Nigeria. The accessible population used in the study was that of Senior Secondary chemistry students from four randomly selected co-educational district secondary schools in Chanchaga LGA, Categorization of schools for the purpose of sampling in the study was based on the school type categorized as: boys' school, girls' school or co-educational.

### 1.7. Significance of the Study

The recognition of a more effective conceptualization of the inquiry method will be of immense benefit to the nation, students, teachers, science, educators, other researchers and educational administrators.

To the nation, evidence of a better method of inquiry will enhance student academic' achievement in Geography and increase the number of students who will go into the study of important science courses like Medicine, Pharmacy, Nursing and Agriculture. These courses of

study will promote the national economic development and also increase the number of scientifically skilled and literate citizens.

To the students, identification of a more effective study method (instructional media aids) will help the students to achieve high in Geography which will make them to opt for science courses in higher institution and also appreciate the things around them.

To the teachers and science educators the identification of better teaching methods will enable teaching and learning process to be more beneficial because student academic achievement will be improved upon and their interest sustained, thus enabling the realization of the stated instructional objectives which is the goal of any academic enterprise.

To parents, it is of great benefit, because they are regarded as first teachers to their children (students) and will help improve and stimulate student's achievement and retention even before been introduce to them in the school.

Furthermore, the study will help curriculum planners to sec the effect of improvisation on students since information and instruction arc practical and physical to learners. It creates the knowledge of usefulness of improvisation and teach the uses of improvisation as an effective and efficient instructional aid

### 1.8. Operational Definition of Terms

**Mastery Learning Approach (MLA):** is an instructional approach in which students are allowed multiple opportunities to acquire and demonstrate mastery of content taught/learnt through breaking down the subject matter of chemistry to be learned into units, each with its own

objectives and evaluation; students are allowed to study content unit after unit, and provided with corrective instruction until they master it.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.0 Introduction

This chapter provides a review of related and relevant literature. The literature are presented under the following headings; theoretical framework, conceptual framework, and summary of reviews.

## 2.1 Conceptual Framework

## 2.2. Methods of Teaching Science

The issue of teaching methods and their effect on secondary school science students‟ performance has been a very important issue in the recent times. The importance of science and technology in the growth of and development of any nation cannot be overemphasized. It is evident that science and technology cannot thrive without using appropriate instructional methods. Future development of any nation in the fields of science depends on how well the science subjects are taught.

There are several methods of teaching and learning science subjects in the course of presenting scientific facts, information, principles and skills on concepts to the students. Some of the methods includes: mastering learning approach, demonstration, inquiry, discovery, discussion, project, laboratory, individualized, fieldtrip, excursion and lecture/ direct expository methods, to mention but a few. Some of these methods which have their characteristics advantages and disadvantages are specific for some situation and categories of students, while others can generally be applied to all categories of students (Atadoga, 2019).

Olorukooba (2011) described the method as a teacher-centered method in which the teacher does the bulk of the talking as he presents large bodies of facts and principles to many students whose role are relegated to that of passive learners. This description is in agreement with an earlier view of Olorukooba (2011) when she stated that the method aims at collecting a large body of information to be disseminated to as large group of people as possible and in the shortest period of time with minimal cost. Atadoga & Onaolopo (2018) also described the method as a didactic approach, defining it as a teaching technique in which one person usually the teacher presents a spoken discourse on a particular subject. They further opined that the method is used for elaborating, simplifying, clarifying and discussing new materials to learners. The method was reported as not being expensive since only chalk and chalk board are required. It allows for easy coverage of syllabus as well as being a faster way to communicate scientific information and facts. Despite these points, the method does not auger well for meaningful learning of science. Since much emphasis is on the sense of hearing. It does not cater for the various ability groups that can be identified in a class. Also it can be boring and frustrating as learners are made to sit for further long-time, writing and listening. It also encourages rote learning without necessary aiding understanding.

Okwilagwe (2013) noted that the method mostly used for teaching and learning of science in Nigerian schools is lecture method, and is not so effective because the students are not given opportunity to interact with the environment and maximally develop their intellectual capabilities. Researches on teaching methods had shown that lecture method had negative effects on students (Okwilagwe, 2013).

Lecture allows a great deal information to be passed to the learners and favors handling of large classes. It encourages students to cram facts which are easily forgotten (Okwilagwe, 2013). Adeyemi (2015) stated that lecture is inappropriate and ineffective for achieving the high objective of science. Therefore, this research work investigated the Impact of Mastery Learning Approach on student achievement and also on motivation among Senior Secondary School Chemistry Students in Chanchaga, Niger State, Nigeria.

### 2.2.1 Lecture Method of Teaching Science

There are various methods that can be used for the presentation of scientific facts, principles, information and concepts to students. One of the oldest and most commonly used method however remains the lecture or expository method (Olorukooba 2013 & Ada 2016). Olorukooba (2013) described the method as a teacher-centered method in which the teacher does the bulk of the talking as he presents large bodies of facts and principles to many students whose role are relegated to that of passive learners. This description is in agreement with an earlier view of Olorukooba (2013) when she stated that the method aims at collecting a large body of information to be disseminated to as large group of people as possible and in the shortest period of time with minimal cost.

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At least eighty percent (80%) of scientific information or principles are passed on to students through lecture method (Adesoji, 2008). He further opined that, many academicians have accepted lecture method as a proper way of imparting knowledge since our educational system puts so much premium on external examinations. Lecture method helps a science teacher covers a large amount of materials (syllabus) to a large class size in a very short period. This is however detriment to students learning, but the teacher may not have a choice being driven by the pressure to cover the syllabus and prepare the students for the external examination which is the only qualifying measure to the next level or employment.

Bichi (2002) posited that seventy five percent (75%) of the scientific information or principles that students received from their teachers comes through expository method. When science is taught using lecture method, students often rote learn and in the process miss an essential part of the science learning. For this study, lecture method will be used to teach the control group.

### 2.2.2Methods of Teaching Chemistry

The term teaching methods refers to the general principles, pedagogy and management strategies used for classroom instruction (Jackson, 2012). According to Sharma (2012),

Methods are the ways and means through which the curriculum is transacted through teachers to the students. It is a link in the process of teaching and learning environment. Joshi (2008) define methods to include a utilization of appropriately selected curriculum materials, content and learning experiences, motivational strategies, an application of learning theories and a demonstration of a knowledge of developmental psychology or other aspects of educational psychology in the teaching and learning process. Ogbonna (2014) opines that one of the most influential factors in teaching is the teachers‟ method of teaching. Ahmed and Abimbola (2011) and Umar (2011) have identified poor teaching methods adopted by teachers at senior secondary school level in Nigeria as one of the factors contributing to the poor performance of students in science subjects.

There are a variety of methods and techniques for teaching the sciences. These include; laboratory method, project method, inquiry method, discussion method and lecture method. The laboratory method of teaching is based on the principle of learning by doing. The students make use of their hands or eyes or very often both. The school laboratory according to Usman (2010) is an instructional facility used by teachers to help students learn about science and how scientists investigate the world around them. The students are led to obtain information by their own active efforts (Joshi, 2018). It is psychologically sound because it satisfies the urge for activity which is fundamental derives in human beings. The proper material and equipment and physical setting help to motivate the students to drink deep from the well of knowledge (Joshi, 2008). It is through the activity that the child is helped to feel the significance of what he is learning. In this method, the students are encouraging finding out, thinking about and experience things for themselves and by themselves. In this method, the students are not mere listeners

but are active participants in the lesson. However, the laboratory method has some demerits (Joshi, 2018). It is very slow method of learning. It is not easy to make the students discover Physical facts or concepts by experiments. The method is also expensive. The method also makes heavy demands on students since it is expected that each students should vary by performing experiment. Usman (2010) in his work proved that laboratory method improved students‟ academic performance in integrated science. He also identified two types of laboratory; indoor and outdoor laboratory. The indoor laboratory is a room/building where scientific work and research is carried out. While the outdoor laboratory is an open space mapped out for scientific activities.

Project method is an educational enterprise in which children solve a practical problem over a period of several days or weeks. It may involve building rocket, constructing an electric bell, hydraulic press, beam or lever balance and so on. This is a method in which students learn through independent activity under the guidance of a teacher (Olaitan & Agusiobo 1992). The project teaching may be suggested by the teacher, but they are planned and executed as far as possible by the students themselves individually or in group. The use of project in teaching Chemistry has to do with assigning work to students or asking them to select certain work and complete it on their own time outside the scheduled class laboratory time. It helps to stimulate students‟ interest and motivation to the study of technical facts and related knowledge in all spheres of learning. It offers a normal organizing centre for new acquisition of skills and knowledge. It is highly useful in developing modes of thought, and understanding of the procedures and characteristics of an occupation. It is also adaptable to the occupations for which vocational education trains the individual in skills of practical value especially those requiring personal initiative and creativity.

Projects are important real world modules by which modern Chemistry and everyday life problems can be integrated into high (or secondary) school curriculum (Holubova, 2008).

According to Olajide and James (2000), inquiry method is an art of questioning, exploring and experimenting which is the process of science. Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation (Logan, 2008). In scientific inquiry, students engage in a thoughtful and coordinated attempt to search out, describe and explain and predict a natural phenomenon (Lohrman, 2013). As highlighted out by Hassard (2005), inquiry method of teaching is of two types: guided inquiry and open inquiry. In guided inquiry, the students determine the methods they will use to produce their own conclusions to a problem posed by the teacher, and as such, the teacher plays the role of a guide to the students. In the open inquiry, the students select the topic to be studied and the methodology used to yield their own conclusions from the investigation. Research has shown that students who have historically been low achiever in science can succeed in inquiry based-learning (Blanchard, 2010). However, Joshi (2008) is of the opinion that inquiry method can be time consuming and slow and may not be suitable under the structured school curriculum.

In the discussion method, as it is true with any group learning effort, the instructor typically relies on the students to provide ideas, experiences opinions and information. An instructor may use this during classroom periods, after the students have gained some knowledge and experience. Fundamentally, the discussion method is almost the opposite of lecture method. The instructor's goal is to draw out what the students know, rather than to spend the class period telling them (Joshi, 2008). It is one of the most easily comprehended method of teaching as students are daily involved in one form of discussion or another within or outside the school (Atere, 2006).

The discussion method places emphasis on learning than teaching and encourages participation by everybody. Thus, there is a development of democratic way of thinking and arriving at decision. Students, during the course of discussion get training in reflective thinking which leads to deeper understanding of the historical problem under discussion. During discussion, everybody is required to express his ideas and opinions in a clear and concise manner. This provides ample opportunities to the students for training in self-expression. Discussion can take place between and among small or large groups of learners during which they can contribute, share, examine and suggest prove, argue, accept or reject ideas or opinions. However, the teacher serves as the facilitator, guide, assistant, moderator or contributor to discussion.

Lecture method is also referred to as conventional methods or expository method of teaching. It is also referred to as the traditional method of teaching and is the oldest method of teaching. According to Appaw (2011), it is mostly described as teacher-centered, teacher dominated, teacher activity method, or top down transmission teaching. It involves verbal presentation of ideas, concepts and generalization of facts (Umar, 2006). The role of the students is less active and more passive in the teaching and learning interaction. It is effective in teaching basic fundamental skills across all content areas (Jackason, 2012). Basically, the teacher controls the instructional process, the content is delivered to the entire class and he tends to emphasize factual knowledge. It allows a great deal information to be pass to the learners but it does not stimulate students‟ innovation, inquiry and scientific attitude. For effective teaching to take place, skillful Chemistry teacher need to use different teaching methods, techniques and approaches at his disposal.A carefully designed teaching method can make teaching and learning effective (Chang & Mao, 2008).

It has been noticed that the methods that results in positive effect on students‟ learning are those based on collaboration between teachers and students. Focusing on this, Nzewi (1993) advocated the use of a more effective method of teaching science; the mastery learning approach (MLA), no doubt can be one of such technique.

### 2.2.3 Mastery Learning Approaches

There are two approaches employed under ML. These are learning for mastery (LFM) and personalized system instruction (PSI). In LFM approach the subject matter is verbally presented while in PSI approach it is presented in a written form, (Bloom, 1968). In both approaches the contents, is divided into small units with specific objectives and arranged in hierarchical order of complexity, Keller (2013). In finding out the effects of CMLA on students' motivation and achievement in this study, LFM was used and the learners who attained the required mastery level were allowed to proceed to the subsequent unit of the topic selected while those who fail to reach the required level of proficiency were given extra tuition. The required level of knowledge proficiency and competence was assessed through formative tests, feedback, remediation and finally summative tests (Bloom, 1968, Kulik, Kulik and Bangert–Drowns, 1990). The LFM approach relies on setting standards of mastery and excellence, followed by a strategy to bring as many students as possible to this standard. In this way students are informed of the performance required but are not in competition for grades. They are to be judged on the basis of levels of mastery actually obtained by students in the previous year. This enables a more cooperative approach; students helping each other without the fear that special advantage is being given to those who are being assisted, (Aggarwal, 2014).

### 2.2.4 Principles of Mastery Learning

The principles of Mastery Learning includes matching teaching to student outcomes, utilizing multiple instructional methods, giving specific feedback, and fostering correctives and extensions. Effective teachers intentionally engage their students in the multiple cognitive levels of thinking described in Bloom's Cognitive Taxonomy: knowledge, comprehension, application, analysis, synthesis, evaluation, creative and complex thinking (Aggarwal, 2014). The planning phase of the instructional process addresses identification of the learning, a task analysis, prerequisite skills, and development of effective questions, strategies, and materials. In the teaching phase, the Cue Set is a step designed to focus student attention and ignite motivation for the learning task. Best Shot is a term which describes teacher's behaviour which models or beams instruction to students, (Bloom, 1987). It centres on a variety of strategies which empower the teacher to instruct through multiple learning modalities hence stimulus variation which is an essential component for active learning is attained. Guided and Independent Practice activities are opportunities for students to actively participate, apply the learning, and experience success. Closure ties together the learning, instructional activities, and expectations in a meaningful summary, (Kullik et al, 1990). Formative and Summative Assessments are terms used to describe the measurement of the student's understanding of the learning concept and their ability to apply it appropriately. Formative Assessment is diagnostic hence aimed at measuring and correcting learning problems while Summative Assessment measures the overall achievement. Formative tests do not count for a grade while summative test do (Block, 1981). Mastery learning therefore, woven into the instructional process reveals a set of sound instructional practices which crate the conditions for the philosophy, "all can learn well" to bloom in the lives of the learners.

In ML strategy, the student is motivated to interact at his own pace with a given learning segment (Aggarwal, 2014). Moreover, the course material is broken into small segments each with an interesting introduction, a list of behavioural objectives, a suggested procedure for learning and a set of self-assessment exercises. In this learning approach, the student is allowed to proceed on to the next learning segment after passing the criterion-referenced test. The criterion-referenced test is to be passed by the student with a minimum cut-off score of 80% marks indicating mastery of the learners' on-going learning segment, (Kullik et al., 1990). A student who does not pass the test is given individual guidance by the instructor and peer-tutors. The student repeats the learning segment and takes retests until he/she passes.

The mastery learning model places focus on aspects such as behavioural objectives, small learning segments, self-pacing, individual attention and criterion-referenced testing (Aggarwal, 2014).

### 2.2.5 An outline of the concept of mastery learning

The notion of mastery learning can be tracked down to early teachers like Comenius, Pestalozzi and Herbart (Bloom, 1974) while its application became popular when Benjamin S. Bloom used the concept "Learning for Mastery" (Bloom, 1968) and Mastery Learning (Bloom, 1971) to explain ways of providing students with instructional materials that would encourage them to learn at their own speed and receive constant corrective feedback on their level of mastery of the prescribed task.

Bloom was inspired by the work of Carrol (1963) who put forward a theoretical model of school learning that describes the degree of learning as a function of time spent or used up in learning divided by the time needed to learns. Carrol's model view students' aptitude rather than intelligence as the index for learning a given school subject, and he (Carrol) defines aptitude as

the amount of time required by a student to learn (or master) the subject to a given level under optimal conditions. By Carrol's model of school learning, all students are able to achieve or learn a given set of objectives or task at a particular level if given the required amount of time, suggesting that the longer the time spent on learning a given topic, the higher the rate of learning that topic.

After series of investigations on the variation that existed in students' learning and achievement due to the mode of instruction, students' assessment and feedback information, Bloom discovered that the key to higher students' achievement is prompt feedback where the students' works were analyzed and corrected Bloom (1968). He then explained and transformed the theoretical model of Carrol to a practical and working model called "Learning for Mastery" (Bloom, 1968) later changed to "Mastery Learning" (Bloom, 1971) for effective school learning. In the classroom situation, Bloom believes that the "time spent" and the "time needed" to learn are not influenced by the student's characteristics alone but also on the characteristics of instruction. To him, the time a student spent or used up in learning or accomplishing a task is a function of the students' perseverance, the opportunity to learn and the time needed to learn. As such Bloom (1976) sees the interaction between students' characteristics – students cognitive entry behaviour (i.e., pre-learning), students' affective or emotional entry behaviour (i.e., motivation); and the quality of teaching or instruction as the determinants of quality learning outcome; that also minimize the individual differences in students learning. To him clear lesson objectives, clue/scaffolding, students' participation, reinforcement and provision of regular feedback and remediation (corrective feedback information) are the essential variables for qualitative teaching or instruction needed to promote mastery learning. Accordingly, Bloom (1976:4) asserts that most students can attain a high level of learning capability if instruction is

approached sensitively and systematically, if the students are given adequate assistance or helped when and where they have learning difficulties, if they are given ample time to learn and achieve mastery, and if there is a well-defined criterion of what constitute mastery. This view underlies the basic philosophy of mastery learning.

Adepoju (2020) defines mastery learning as an innovation which in its various form is designed towards making learners perform beautifully well on an academic task. Mastery Learning Strategy (MLS) can be regarded as a student-centered teaching strategy designed to increase students' learning and academic achievement by making the to acquire and master a predetermined learning task or unit of instruction before progressing to the next. It lay down the goal(s) to be achieve, and provides students with individualized instructions as well as different instruction time to attain the predetermined achievement goal. The strategy makes it easier for students to study a given material unit by unit until they master the material; and therefore, allows them to have the necessary prerequisite knowledge/skills as frame of reference to approach higher units of instruction.

### 2.2.6 Mastery learning and academic achievement

Results of several research conducted on MLS revealed that MLS is an important instructional approach for promoting students' academic achievement in school subjects (Iserameiya and Ibeneme, 2018; Mitee and Obaitan, 2015; Adeyemo and Babajide, 2014; Damavandi and Kashani, 2010; Wambugu and Changieywo, 2008; Adeyemi, 2007; Kazu and Ozdemir, 2005). In a study on the effect of mastery learning strategy on the academic achievement of students in Edo State, Iserameiya & Ibeneme (2018) used 119 (comprising 66 male and 53 female) Junior Secondary School Two students from two selected schools in Edo Central and found that students taught Basic technology through Mastery learning strategy differ significantly as they

perform better in their post basic technology achievement test in contrast to those taught through the direct instruction method.

Mitee & Obaitan (2015) studied how mastery learning affects secondary school students' cognitive learning outcome in quantitative aspect of secondary chemistry and stated that mastery learning is a better and an effective teaching method when compared to the conventional teaching method. Damavandi & Kashani (2010) found out from their study on mastery learning method and its effects on performance and attitude of weak students in chemistry that weak students taught using the mastery method had higher chemistry performance than those who were subjected to common learning method. Hutcheson (2015) study to validate the effect of mastery learning approach on student motivation among middle level science revealed that students taught via mastery learn learning approach had an overall increase

### 2.2.7. Motivation and Performance (Achievement) in Chemistry

Motivation is a strong desire or passion in a person that encourages him to try and do something in order to succeed. It is a construct that is built out of individual learning activities and experiences, and it varies from one situation or context to another (Bandura, 1997). Motivation effects student learning (Ormrod, 2012) and plays an important role in directing behavior towards a certain goal, increasing the effort and energy towards a goal, increasing the initiative and perseverance of an activity, and improves individual performance. Motivation is the key factor in keeping students in their learning process, and has been found to be the most significant factor that influences academic success (Pintrich et al., 1994). A motivated student will take care of his education, has a positive thinking and is always eager to learn. Teaching would be meaningless if the student is not motivated, even when the capacity and capability of teachers are high. Self-motivation is essential to generate the potential for excellence and is inter-related with

the spirit and desire to succeed, as well as having a strong impact on one's success and performance (Petri, 2016 & Singh et al., 2018).Students who have high or strong motivation have been found to possess a more positive attitude towards Physics (Ali, Ismail &Sedef, 2011), are willing to learn the subject more effectively (Pintrich & Maehr, 2004),and are able to contribute better in classes and in the school‟s overall development (Eccles et al., 1998).). Highly motivated students are also generally linked to the increase in the levels of student success rates and reduced dropout rates (Dev, 1997; Blank, 1997).Therefore, understanding motivation is necessary in designing an instructional process that can attract students towards a taught subject (Fisher & Horstendahl, 1997). It is well known that students‟ motivation is influenced by both internal and external factors that can start, sustain, intensify or discourage behaviors.

Internal factors include the individual characteristics or dispositions that a student brings towards his learning activity such as interest, responsibility for learning, effort, values and perceived ability (Ainley, 2014). On the other hand, external factors include external rewards that come from the outside of the individual, such as money, praises and grades. Study results have indicated that individuals who are intrinsically motivated, compared to those who are extrinsically motivated, master information and concepts longer have more interest, excitement, fun, and confidence, which leads to enhanced performance, creativity, persistence, vigor, general well-being, and self-esteem, as well as more likely to be lifelong learners. Therefore, finding the ways to enhance intrinsic motivation for students is of utmost importance. Motivation plays a major role in students‟ academic work and in their performance. It reflects in students‟ choices of learning tasks, in the time and effort they devote to them, in their persistence on learning tasks, in their coping with the obstacles they encounter in the learning process. Previous research

(Wiegfield, Harold, Freedman, Ecles, Yoon, Arbreton&Blumenfeld, 1997; Zohar, 1998; Bandalos, Geske& Finney 2015; Chemers, Hu & Garcia, 2015; Senko &Harackiewicz, 2015) showed that students‟ performance goals, their interest in courses and their success expectancies were positively related to their final course grade. Research findings of Walberg in Singh, Granville, and Dike, (2002) showed that motivational variables and instructional time have the largest effect on eight- grade performance. Continuing, Singh, Granville, and Dike (2002) noted that the body of accumulated research in the last two decades indicates that motivation is one of the salient predictors of performance in mathematics and science. Such research works which link performance in science with motivation includes the findings of Brown and Walberg (1998), Nolen (2003), Geary and Hamson (2007).Psychological studies have provided insights on the effect of motivation on student's performance in Chemistry, Physics, and mathematics. Geary and Hamson (2007) for instance found that explaining the importance of mathematics to students as a motivational variable, increased the participation in science classes in high school.

Studies which specifically investigated students‟ motivation and ability have yielded interesting findings in relation to their motivation. Talib, Wong, Azhar, and Abdullah (2009) conducted an in-depth study on motivation of students with outstanding performance in academics and revealed that good science learning outcomes do not rely on the way teaching is carried out but on many factors which include students‟ ability, interest and motivation to learn. Feldhusen and Hoover (1986) identified self-concept and motivation as the most important factors for high ability students‟ academic performance. Other studies report that high motivated and ability students have higher scores than low ability and motivated students on academic goals, valuing science, and perceived ability (Debacker& Nelson, 2000) and they have more positive attitudes toward science in terms of interest and career in science than low ability and motivated students

(Adams, 1996).Therefore, this study investigated the Impact of Mastery Learning Approach on Achievement or performance among Senior Secondary School Chemistry Students in Chanchaga, Niger State Nigeria.

**2.2.8 Gender and Academic Achievement in Science Education.**

Academic achievement or performance refers to the extent to which a student, teacher or institution has achieved their short or long-term educational goals Adamu (2014) posited that the computed or grades recorded for a group of learners is what constitute their academic performance for a given period of time. Linn (1992) opined that the performance of an individual for a given learning period influences his future choice career. He asserted that the ability of a student to make higher grades make such a student to choose courses in future that shows the correlation with his performance at lower level courses.

A student wishing to study medicine in future may be encouraged by performances in science subjects like: Biology, Chemistry, and Physics at lower level. If his record of performance at lower level is high with prerequisite subjects of the course he intends to pursue, then he is more likely to make success or even excel in his intended field (Wong, 2016). According to the International Assessment Event of Education Progress (IAEP, 1992), students making meaningful progresses in their choices of career are those mostly with relevant background mostly with relevant background and a good record of academic performances at lower level.

Research work carried out on gender related effects on academic performance have shown a markedly low performance of females students than their male counterparts in science educational programme and science related courses (Sharma, 2013). This low performance of females over their male counterpart lead to greater dominance of males over females compared

to their male counterparts in the field of science and technology has lead many scholars to say that science is gendered as it is practice (Akanbi, 2002).

In a study conducted by Abiola (2007) requesting male and female students to indicate their preference in the choice of subjects, using rank correlation coefficient, he observed that male students preferred to learn mathematics manipulative skills for subjects such as chemistry, Physics and engineering courses while their female counterparts preferred subjects such as Biology and other subjects that required reading skills like literature. This argument however, can be valid in coeducational schools and may not necessarily be valid in places where schools are single sexed schools (Oladejo, 2011). Bichi (2012) observed that female students generally do not like practical work and thus cannot effectively learn under teaching method involving practical activities. Science teachers play a vital role in addressing the problem of gender in science education. According to Levi (2011), there are three roles a science teacher must play. Namely:

i. Ensure provision of equal opportunities and respect for differences in the classroom.

ii. Ensure that boys and girls have the same experience and that is, treat boys and girls equally.

iii. Compensate for gender difference in the society.

In order for concepts in Chemistry to be properly learnt and understood, the methods used in teaching the concepts play a vital role. Poor performance in chemistry could be attributed to many factors among which teacher's strategy was considered as an important factor (Adeyemo & Babajide 2014). This implies that the mastery of chemistry concepts might not be fully achieved without the use of instructional materials. Franzer, Okebukola and Jegede (1992) stressed that a professionally qualified science teacher no matter how well trained, would unable to put his ideas into practice if the school setting lacks the equipments and materials necessary

for him or her to translate his competence into reality. Nwaigbe (2001) opined that lack of instructional materials is a factor responsible for women backwardness in science literacy. This study seek to investigates the impact of mastery learning approach on secondary school Chemistry students achievement will therefore fill this gap of gender difference in teaching and learning Chemistry.

**Advantages of mastery learning**

1. Students have prerequisite skills to move to the next unit

2. It requires teachers to do task analysis, thereby becoming better prepared to teach each unit

3. It requires teachers to state objectives before designating activities

4. It can break the cycle of failure (especially important for minority and disadvantaged students)

**Disadvantages of mastery learning**

Critics of mastery learning approach argue that it does not help high ability students because they are held back waiting for the slow learners. Bloom states that the enrichment component of mastery learning approach engages the learners who attain mastery at the initial time with more learning activities while other go through remedial lessons and re-testing. Critics also note that MLA requires considerable amount of time and effort for implementation, which many teachers and schools are not prepared to expend. However, developers of mastery learning believe that this can be overcome after initial problem of implementation.

### 2.2.9 The Conventional Approach

Lecture method is the traditional and prevailing method of disseminating knowledge at virtually all levels of academics in Nigeria. It is also called the talk and chalk method. It is therefore, the conventional approach of teaching. The teacher does the bulk of the talking as he presents large

body of facts and principles to many students in a teacher-centered mode. This instructional method is mainly authoritarian in nature.

Lecture method is the traditional and prevailing method of disseminating knowledge at virtually all levels of academics in Nigeria. It is also called the talk and chalk method. It is therefore, the conventional approach of teaching. The teacher does the bulk of the talking as he presents large body of facts and principles to many students in a teacher-centered mode. This instructional method is mainly authoritarian in nature. Lecture method provides careful, lucid presentation of materials. Participants see the professional mind at work, and it effectively conveys large amount of information in a short space of time. This may be why it is so appealing to our teachers (Olarewaju, R.R., 2012). However, in a haste to cover the syllabus expediently, teachers do not pay attention to whether the students understand content or not. Since the teacher controls the transmission and sharing of knowledge, s/he attempts to maximize the delivery of information while minimizing time and effort. As a result, both interest and understanding of students may get lost. Studies on underachievement of students in secondary school subjects reported inefficient teaching methods by school teachers as a major factor for the underachievement of students (Filgona, J., 2016).

The conventional approach does not accommodate the natural diversity in learning abilities among different groups of students. It does not provide a flexible approach that accommodates all students according to their respective levels of learning and understanding. This type of learning strategy does not enhance students' achievement nor stimulate students to be more actively involved in the teaching learning process. In contrast to mastery learning approach, conventional approach does not make provision for specification of cognitive objectives, division of course content into units, formative diagnostic evaluation, and remedial instruction. In the

mastery learning classroom, assessment is not used as a measure of accountability but rather as a source of evidence to guide future instruction and remediation; this is not the case in the conventional classroom (Filgona, J., Filgona, J., & Sababa, L.K. , 2017).

The most important difference between the conventional and mastery learning approach is the fact that in the conventional classroom, the teacher keeps moving learners from unit to unit based on the planned scheme of work for the term/session irrespective of how many students have achieved mastery of the content. The conventional approach holds time constant and allows mastery to vary while mastery learning approach holds mastery constant and allows time to vary. The search for improved strategies as an alternative to the conventional approach for teaching and learning of science is a continuous process.

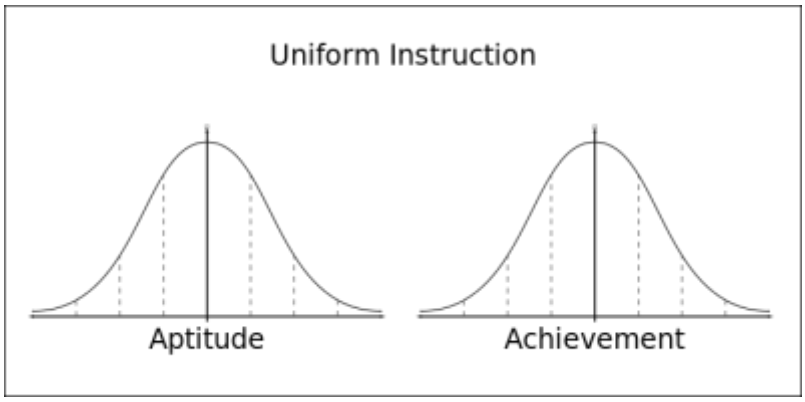
### 2.3.0 Theoretical framework

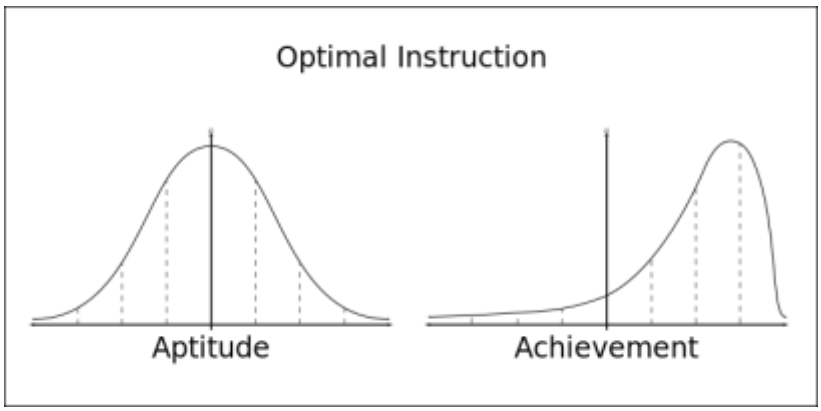
#### 2.3.1. Major proponent of mastery learning

Calsyn and Kenney. (2017) submitted that the main developer of the theory and practice of mastery learning has been Benjamin Bloom, an educator at the University of Chicago. Benjamin Bloom in 1968 proposed mastery learning as an instructional strategy. Bloom maintains that students must achieve a level of mastery (e.g. 90% in a knowledge test) in prerequisite knowledge before moving forward to learn subsequent information. If a student does not achieve master on the test, they are given additional support in learning and reviewing the information and then tested again. The cycle continues until the learner accomplishes mastery, and they may then move to the next stage.

In mastery learning, the focus of instruction is on time required for different students to learn the same material and achieve the same level of mastery. Students' failure is more due to instruction

and not necessarily lack of ability on students' part. Therefore, in a mastery learning environment, the challenge becomes providing enough time and employing instructional strategies so that all students can achieve the same level of learning.




Bloom condemned the normal curve for grading students performance saying that all students can be successful (more than 90%) if educators are effective.

### 2.3.2. Benjamin S. Bloom's 'Learning for Mastery'

Benjamin S. Bloom, Distinguished Service Professor at the University of Chicago, was impressed by the optimism of Carroll's perspective on learners and particularly by the idea that

students differ in terms of the time required for learning rather than their ability to learn. If aptitude was indeed predictive of the time a child would require to learn, Bloom believed it should be possible to set the degree of learning expected of each child at some mastery performance level. Then by attending to the instructional variables under teachers' control the opportunity to learn and the quality of the instruction teachers should be able to ensure that every child attain that specified level.

To determine how this might be practically achieved, Bloom first considered how teaching and learning take placein typical group-based classroom settings. He observed that most teachers begin by dividing the concepts and skills that they want students to learn into smaller learning units. These units are usually sequentially ordered and often correspond tothe chapters in the textbook used in teaching. Teachers then teach the unit concepts to all students in the same way, provide all students with the same amount of time to learn,and evaluate students' learning at the end with some form softest or assessment. The few students for whom the instructional methods and time were ideal learn excellently and perform well on the unit assessment. The largest number of students for whom the methods and time were only moderately appropriate learns less well. And students, for whom the instruction and time were inappropriate due to differences in their backgrounds or learning styles, learn very little and perform poorly on the unit assessment. To attain better results and reduce this variation in student achievement, Bloom reasoned that we would have to increase variation in the teaching. In other words, because students varied in their learning styles and aptitudes, teachers must diversify and differentiate instruction to better meet students 'individual learning needs. The challenge was to find practical ways to do this within the context of group-based classrooms so that all students learn well.

In searching for such a strategy, Bloom drew primarily from two sources of evidence. First, he considered the ideal teaching and learning situation in which an excellent tutor is paired with each student.

In examining this evidence, Bloom sought to determine what crucial elements in one-to-one tutoring and individualized instruction could be transferred to group-based classroom settings.

Second, Bloom looked at studies of the learning strategies of academically successful students, especially the work of Dollard and Miller (1973). From this research he tried to identify the activities of high-achieving students in group-based classrooms that distinguish them from their less successful classmates. Bloom saw value in teachers' traditional practice of organizing the concepts and skills they want students to learn into learning units. He also considered it important for teachers to assess student learning at the end of each unit. But the classroom assessments most teachers used seemed to do little more than show for whom their initial instruction was and was not appropriate.

Bloom believed that a far better approach would be for teachers to use their classroom assessments as learning tools, and then to follow those assessments with a feedback and corrective procedure. In other words, instead of using assessments only as evaluation devices that marks the end of each unit,

Bloom recommended using them as part of the instructional process to diagnose individual learning difficulties (feedback) and to prescribe remediation procedures (correctives).

This is precisely what takes place when an excellent tutor works with an individual student. If the student makes an error, the tutor first points out the error (feedback) and then follow-up with further explanation and clarification (correctives) to ensure the student's understanding. Similarly, academically successful students typically follow up the mistakes they make on

quizzes and assessments. They ask the teacher about the items they missed, look up the answer in the textbook or other resources, or rework the problem or task so that they do not repeat those errors. With this in mind, Bloom outlined an instructional strategy to make use of this feedback and corrective procedure, labeling it 'learning for mastery' (Bloom, 1968), and later shortening it to simply 'mastery learning' (Bloom, 1971a). With this strategy, teachers first organize the concepts and skills they want students to learn into learning units that typically involve about a week or two of instructional time. Following initial instruction on the unit, teachers administer a brief quiz or assessment based on the unit's learning goals. Instead of signifying the end of the unit, however, this assessment's purpose is to give students information, or 'feedback,' on their learning. To emphasize this new purpose Bloom suggested calling it a formative assessment, meaning 'to inform or provide information.'

### 2.3.3. Feedback, Correctives, and Enrichment

Teachers who use mastery learning provide students with frequent and specific feedback on their learning progress through regular, formative classroom assessments. This feedback is both diagnostic and prescriptive. It reinforces precisely what students were expected to learn, identifies what they learned well, and describes what needs to be learned better. The US National Council of Teachers of Mathematics (NCTM) emphasizes this same element in its latest iteration of the standards for school mathematics. To overcome inequities in mathematics instruction, NCTM stresses the use of assessments that support learning and provide useful information to both teachers and students (NCTM, 2012).

Feedback alone, however, does little to help students improve their learning. Significant improvement requires that feedback be paired with correctives: activities that offer guidance and direction to students on how to remedy their learning problems. Because of students' individual

differences, no single method of instruction works best for all. To help every student learn well, therefore, teachers must differentiate their instruction, both in their initial teaching and especially through the corrective activities (Bloom, 1976). In other words, teachers must increase variation in their teaching to decrease variation in results. To be effective, correctives must be qualitatively different from the initial teaching. They must provide students who need it with an alternative approach and additional time to learn. The best correctives present concepts differently and involve students in learning differently than did the initial instruction. They incorporate different learning styles, learning modalities, or types of intelligence. Although developing effective correctives can prove challenging ,many schools find that providing teachers with time to work collaboratively, sharing ideas, materials, and expertise, greatly facilitate the process (Guskey, 2018).

Most applications of mastery learning also include enrichment or extension activities for students who master the unit concepts from the initial teaching. As described above, enrichment activities offer students exciting opportunities to broaden and expand their learning. They reward students for their learning success and challenge them to go further. Many teachers draw from activities developed for gifted and talented students when planning enrichment activities, both to simplify Implementation tasks and to guarantee these students a high quality learning experience.

Teachers implement the feedback, corrective, and enrichment process in a variety of ways. Many use short, paper-and pencil quizzes as formative assessments to give students feedback on their learning progress. But formative assessments also can take the form of essays, compositions, projects, reports, performance tasks, skill demonstrations, oral presentations, or any device used to gain evidence on students' learning progress. In essence, teachers adapt the format of their formative assessments to match their instructional goals.

Following a formative assessment, some teachers divide theclass into separate corrective and enrichment groups. While the teacher directs corrective activities, guaranteeing that all students who need the extra time and assistance take part, the other students work on self-selected, independent enrichment activities. Other teachers pair with colleagues and use a team teaching approach. While one teacher oversees corrective activities, the other monitors enrichments. Still other teachers use cooperative learning activities in which students work together in teams to ensure all reach the mastery level. Since students have their own personal scores on the formative assessment, individual accountability is assured. Offering the entire team special recognition or credit if all members attain mastery on the second formative assessment encourages group responsibility.

Feedback, corrective, and enrichment procedures are crucial to mastery learning, for it is through these procedures that mastery learning differentiates and individualizes instruction.

In every learning unit, students who need extended time and opportunity to remedy learning problems receive these through the correctives. Students who learn quickly and find the initial instruction highly appropriate have opportunities text end their learning through enrichment. As a result, all students experience more favorable learning conditions and more appropriate, higher-quality instruction (Bloom, 1977;Guskey, 2018).

### 2.3.4. Misinterpretations of Mastery Learning

Shortly after Bloom presented his ideas on mastery learning, misinterpretations began to occur. Some early attempts to apply mastery learning, for example, were based on narrow and inaccurate understandings of Bloom's theory. These efforts focused only on low-level cognitive skills, attempted to break learning down into small segments, and insisted that students 'master'

each segment before being permitted to move on.Teachers were regarded in these programs as little more than managers of materials and record-keepers of student progress.

Unfortunately, similar misinterpretations of mastery learning continue today. Nowhere in Bloom's writing, however, can this kind of narrowness and rigidity be found. In fact, Bloom emphasized quite the opposite. He considered thoughtful and reflective teachers vital to the successful implementation of mastery learning and continually stressed flexibility in its application. In his earliest description of the process Bloom wrote: There are many alternative strategies for mastery learning. Each strategy must find some way of dealing with individual differences in learners through some means of relating the instruction to the needs and characteristics of the learners. The non-graded school is one attempt to provide an organizational structure that permits and encourages mastery learning.

Bloom further emphasized his belief that instruction in mastery learning classrooms should focus on higher-level learning goals, not simply basic skills. He noted: I find great emphasis on problem solving, applications of principles, analytical skills, and creativity. Such higher mental processes are emphasized because this type of learning enables the individual tolerate his or her learning to the many problems he or she encounters in day-to-day living. These abilities are stressed because they are retained and utilized long after the individual has forgotten the

Detailed specifics of the subject matter taught in the schools. These abilities are regarded as one set of essential characteristics needed to continue learning and to cope with a rapidly changing world.

Modern research studies have shown mastery learning to be particularly effective when applied to instruction focusing on higher-level learning goals such as problem solving, drawing inferences, deductive reasoning, and creative expression. When well implemented, the process

helps teachers improve student learning and close achievement gaps in a broad range of learning goals from basic skills to highly complex cognitive processes. Another misinterpretation comes from educators who believe that the constraint of limited class time will inhibit efforts to implement mastery learning. They assume that the introduction of feedback, corrective, and enrichment procedures will reduce the amount of material teachers will be able to cover. In other words, teachers will have to sacrifice coverage for the sake of mastery. But as discussed earlier, minor alterations in instructional pacing typically resolve this concern. Early mastery learning units usually do require more time. Teachers who allow class time for students to complete corrective activities often find themselves 'behind' other teachers who teach in more traditional ways after the first two or three units. But once students become familiar with the process, mastery learning teachers generally pick up their pace.

**2.3.5. Bloom's stages of mastery learning model**

Dolan (1986) explained Bloom's stages of mastery learning as follows:

The first stage Bloom describes is one where he believed that some students are good learners and that's how it will always be. The good learners can learn more in terms of both quantity and quality -- that is, they can cover more material, learn more complex content, learn faster, and retain better than poor learners. What follows from this belief is an educational system that tries to sort the good learners from the poor ones, and to teach each group that which it is capable of learning. In such a system, the difference in achievement between the good and poor learners grows greater with every year the students are in school.

The above is a fairly accurate description of what happens now in most American schools. Bloom, however, says this is not what has to happen -- it is simply a result of what most educators believe and the way they teach.

The second stage Bloom describes is one where he believed that all students can eventually learn and retain equally complex or difficult material, but that some will learn much faster than others. This belief would suggest an educational system where the really important content is taught to everyone (with some taking longer than others to learn it), and then the faster learners get lots of enrichment.

Early mastery learning approaches were based on the above belief. However, after years of research with these approaches, Bloom found to his surprise results that led him to his third, and current, set of beliefs. He found that, if students are given favorable learning conditions, even the differences in their rate of learning disappear. In other words, if the schools do their job right, 95% of all students are capable of learning the same amount of material to the same level of difficulty at the same rate and with the same attitude toward learning. This is the belief statement that is now the central core of mastery learning. Bloom states it this way: "most students become very similar with regards to learning ability, rate of learning, and motivation for further learning when provided with the favorable learning conditions."

### 2.4.1. Empirical Study

Mitee & Obaitan (2015) conducted an experimental study to explore “the effect of mastery learning on senior secondary school students’ cognitive learning outcome in quantitative chemistry and concluded that mastery learning is a very effective teaching method and better than the conventional teaching method. Hutcheson (2015) carried out an experimental study in order to find out the effect of mastery learning approach on student motivation in middle level science and arrived at the result that students showed an overall increase in their motivation and academic achievement when taught through mastery learning approach. Udo and Udofia (2014) conducted an experimental study to investigate the effects of mastery learning strategy on

students' achievement in symbols, formulae and equations in chemistry and found that students taught using mastery learning strategy performed significantly better than those taught using the traditional expository method and that gender had a significant influence on the students' performance with the males outperforming their female counterparts.

Likewise, a research study has been carried out by Sarita and Jyoti (2014) to examine the effectiveness of mastery learning model on achievement of pupils' of ix class in chemistry and they found that better gain scores were obtained by the students taught chemistry through the mastery learning model compared to those who weretaught through conventional teaching (ii) Superior performance on the criterion achievement test showed by thegroup of students taught chemistry through Mastery Learning Model as compared those taught chemistrythrough conventional teaching. Agboghorom (2014) conducted an experimental study to investigate the effect of mastery learning approach on secondary students' integrated science achievement and concluded that Mastery learning approach resulted in higher achievement and found an effective teaching method. Adeyemo & Babajide (2014) carried out an experimental study to explore the effect of mastery learning approach on Students' Achievement in Physics and concluded that students showed better performance taught through mastery learning approach than those taught through traditional learning approach. An experimental study has been conducted by Sood (2018) to explore the effect of mastery learning strategies on concept attainment in geometry among high school students and found that Bloom's LFM and Keller's PSI were significantly found more effective in attainment of geometrical concepts as compared to conventional method of teaching but Bloom's LFM was significantly better in attainment than Keller's PSI. Achufusi and Mgbemena (2012)conducted an experimental study to examine the "effect of using mastery learning approach on academic achievement of senior secondary school II physics students" and

found that the experimental group achieved significantly ($p<0.05$) better than the control group. The female students achieved slightly better than their male counterparts but the difference was not significant at P=0.05.

Using quasi-experimental non-randomized pretest-posttest control group design, Vincent (2014) carried out a study aimed at finding the effects of Mastery Learning Approach (MLA) on students' Achievement in Integrated Science. The population was JSS III Students of schools in Delta Central Senatorial District of Delta State, Nigeria. Purposive sampling technique was used to obtain a sample of four co-educational secondary schools. Each school provided one JS III class for the study, hence a total of 120 students were involved. The students were taught the same Integrated Science topic of Drug Abuse and Metabolism in the Human body. In the experimental group MLA teaching method was used while the conventional method was used in the control group. The experimental group was exposed to MLA for a period of four weeks. Pretest was administered before treatment and a posttest after four weeks of treatment. The instrument used in the study was Integrated Science Achievement Test (ISAT) with a reliability co-efficient alpha of 0.74. Data were analyzed using ANCOVA statistics. The hypotheses were tested at 0.05level of significance. The result of the study showed that MLA teaching method resulted in higher achievement. The researcher concluded that MLA is an effective teaching approach, which Integrated Science teachers should be encouraged to use and should be implemented in all teachers' education programmes in Nigeria and other African nations.

The reviewed study was carried out on Integrated Science students in Delta State, Nigeria; the present study which is also in mastery learning effects, was carried out on Biology students in Benue State, Nigeria. While the reviewed study considered the effect of MLA only on students'

achievement, the present study attempted to fill the gap by investigating key variables of achievement and students' motivation in Chemistry when mastery learning approach is used.

In a study carried out at Bariga & Somolu Local Government Areas of Lagos State, Adeyemo and Babajide (2014) investigated the effect of Mastery Learning Approach (MLA) on students' achievement in Physics. Using stratified random sampling, a total of 160 Senior Secondary school II Physics students from 4 selected Senior Secondary Schools were used for the study. The study answered two research questions and tested two hypotheses. The study was a non-randomized pre-test post-test control group design. Students in the experimental group were exposed to MLA teaching method while those in the control groups were exposed to the Conventional Teaching Method (CTM). The instruments used in the study were Physics Achievement Test (PAT) to measure students' achievement and a questionnaire on 4-point scale was used to measure their attitudes towards Physics. t-test and Analysis of Variance (ANOVA) were used in analyzing the data. The result showed that students exposed to MLA performed better than those taught using CTM. Also students with positive attitudes towards Physics performed better than those with negative attitudes towards Physics. Consequently, it was 60 recommended that MLA should be encouraged in schools for improved students' achievement and positive attitude towards physics.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.0 Introduction

This chapter covers the following: research design, the area of study, target population, sample size, sampling procedures, research instruments, pilot study, validity and reliability of instruments, data collection procedures, data analysis and logistical and ethical consideration.

## 3.1 Research Design

The Quasi experimental design was adopted for this study the research design is majorly accepted when there is non randomization of research subject and it precisely, involves pre-test, post-test, and student motivation questionnaire non-control equivalent group design. This design was use because it was not possible for the researcher to randomly sample the subject and allocate them to group without unsettling the academic programmes of the schools involved in the study this design, a total of 160 SS2 Chemistry students will be randomly selected, pretested and divided into two equivalent groups, viz experimental and control. The experimental groups will be then taught concepts of Chemistry using Mastery Learning Approach while the control groups were taught same concepts without using mastering method for a period of 2 weeks. The two groups will be post tested respectively

## 3.2 Population of the study

The target population for the study was SS2 chemistry students in co-education across all senior secondary schools in Minna Chanchaga local Government area of Niger State, with a total number of five thousand, one hundred and seventy (5170|) students. These schools are from four administrative divisions in Minna, Chanchaga local government area.

### 3.3 Sample and Sampling Technique

The researcher employed simple random sampling technique in picking one class from each of the selected school, which then categorized into; Mixed, Boys' are 140 and 56 Girls 'was use for the study from the four selected schools in Minna, Chanchaga local Government Area.

### 3.4 Research Instruments

The data was collected using two instruments;

(i) Student Motivationl Questionnaire

(ii) Chemistry Achievement Test

In the present study data will be collected using two instruments namely, Student Motivation Questionnaire (SMQ) and Chemistry Achievement Test (CAT). The researcher adopted the SMQ developed and used by Barchok (2014). This SMQ was based of likert scale type and measured students' motivation towards the learning of chemistry.

### 3.5 Validity of Research Instruments

The study used content and face validity and this was done by two lecturers in science education. Content validity is the extent to which an instrument yields adequate coverage of the study topic whereas construct validity measures the extent to which data obtained from an instrument accurately represents a theoretical concept.

### 3.6 Reliability of Research Instruments

The researcher carried out a trial testing of the Teacher Made Chemistry Achievement Test and Student Motivation Questionnaire to estimate the internal consistency or reliability coefficient of the instruments. The instruments were administered to a class of S.S II students from a school close to one of the schools selected for the study. The internal consistency of the Chemistry Achievement Test was determined using Kuder Richardson Formula 20 (K-R 20) method.

Kuder Richardson was used because the test items involved multiple-choice items. The internal consistency coefficient r = 0.85 was gotten.

Again Cronbach's Alpha method, which is a modified version of K-R 20 formula was used to establish the reliability of the Student Motivation Questionnaire. The internal consistency of the AII was computed as 0.76 with the use of Special Package for Social Sciences (SPSS).

**3.7 Method of Data collection**.

The researcher obtained permission from the Ministry of Education to collect data from the sampled schools. A visit to Minna Sub-metropolis Education Office was made so as to seek permission to undertake research in the schools under the Sub-Metropolis Education Officer's jurisdiction. The researcher also visited the sampled schools and sought permission from the head teachers to collect data in their schools and gave his timetable on when to visit the schools for the actual data collection. The researcher set a date and presented the questionnaires to both the teachers and students attached in Appendix A and A.

**3.8 Method of Data Analysis**

The data was analyzed using the Statistical Package for Social Science (SPSS) program according to the objectives of the study. This enabled the researcher to describe meaningfully distribution of scores using descriptive and inferential statistics. For descriptive statistics frequency tables, bar graphs and means and T-test were used.

# CHAPTER FOUR

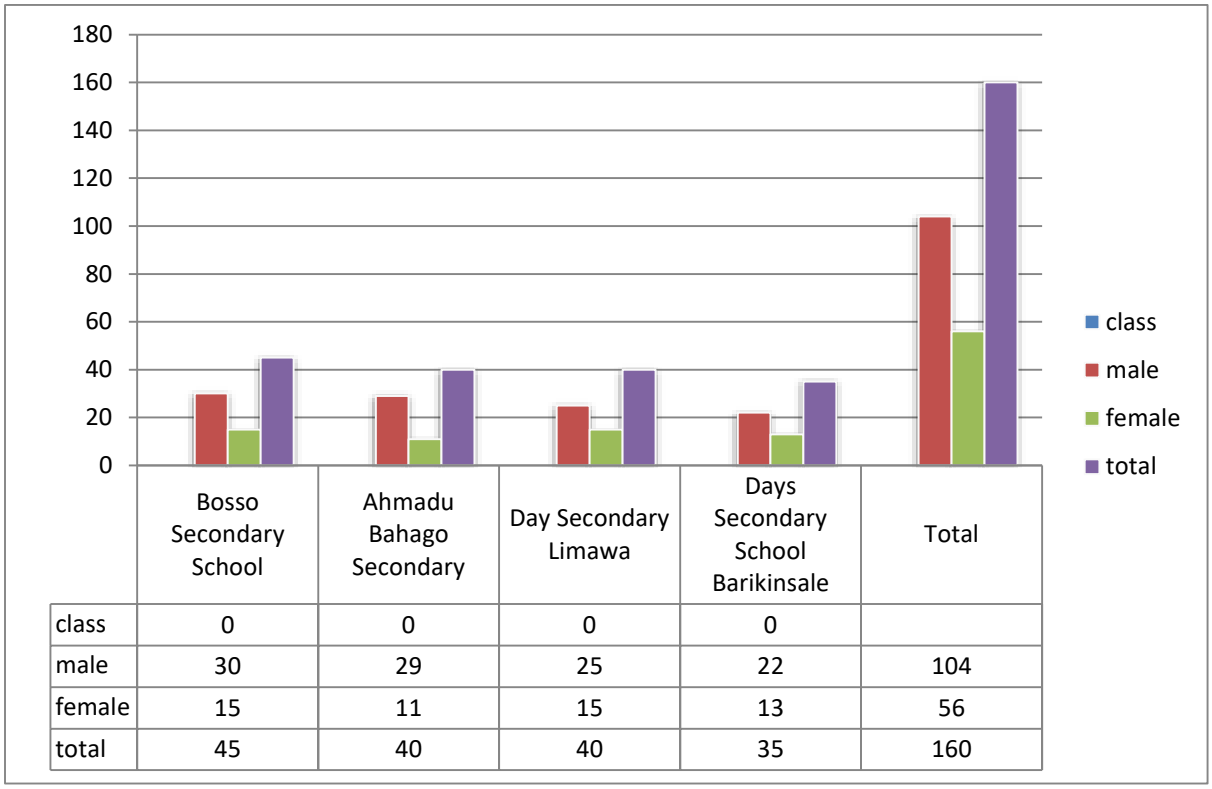
# DATA ANALYSIS AND RESULTS

## 4.1 Introduction

The chapter presents the data analysis based on the responses of secondary school students to the questionnaire administered to them using mean, standard deviation, t-test and one way ANOVA (Analysis of Variance) in SPSS. Four research questions and the hypotheses stated in the study were analyzed, presented on tables, interpreted and summarized.

## 4.1 Demographics of Respondents

### 4.1.1 School and Gender of Respondents




| | Bosso Secondary School | Ahmadu Bahago Secondary | Day Secondary Limawa | Days Secondary School Barikinsale | Total |
|---|---|---|---|---|---|
| class | 0 | 0 | 0 | 0 | |
| male | 30 | 29 | 25 | 22 | 104 |
| female | 15 | 11 | 15 | 13 | 56 |
| total | 45 | 40 | 40 | 35 | 160 |

## 4.2 Research Questions

**4.2.1** What is the difference between the mean scores of students taught using mastery learning approach and those taught using lecture method?

**Table 4.1: Mean and Standard Deviation showing the Mean Response of Respondents' students taught using mastery learning approach and those taught using lecture method?**

| Statement | | Mean | N | d.f | Std. Deviation |
|---|---|---|---|---|---|
| Pair 1 | CONTROL GROUP | 10.41 | 85 | 158 | 2.589 |
| | EXPERIMENTAL GROUP | 17.68 | 75 | | 2.505 |

Table 4.1 Shows the mean and standard deviation of the experimental and control group. Mean score of the experimental group though thought using mastery approach is 17.68 and S.D = 2.505, While the mean score of the control group without mastery approach is 1o.41 and S.D = 2.589 and df= 158. The marginal mean score is 14.045. There for the mean score of the experiment group is greater than that of the control group, this mean that use of mastery method enhance Students' achievement leading to a difference between the meant scores of the two groups.This finding answers research question one.

### 4.2.2 Research question two:

What is the motivational level between students taught using mastery learning approach.

**Table 4.2: Mean and Standard Deviation showing the Mean Response of Respondents' on the motivation of students taught using mastery learning approach.**

| Statement | N | Mean | Std. Deviation | Remark |
|---|---|---|---|---|
| PQ1 | 75 | 3.63 | .653 | Agree |
| PQ2 | 75 | 3.79 | .412 | Agree |
| PQ3 | 75 | 3.71 | .632 | Agree |
| PQ4 | 75 | 3.23 | .863 | Agree |
| PQ5 | 75 | 2.73 | 1.004 | Agree |
| TIQ1 | 75 | 3.40 | 1.013 | Agree |
| TIQ2 | 75 | 3.12 | .697 | Agree |
| TIQ3 | 75 | 3.52 | .665 | Agree |
| TIQ4 | 75 | 3.31 | .788 | Agree |
| TIQ5 | 75 | 3.03 | 1.000 | Agree |
| GRAND MEAN | | 3.347 | | |

Table 4.1 shows the mean response of the motivational level of students taught using mastery learning approach. The mean response of students in all item in table 4.2 shows that mastery learning approach help student improve in there learning process and through motivation.

**4.2.3 Research question three:** What is the difference between level of motivation of male and female students taught using mastery learning approach?

**Table 4.3: Mean and Standard Deviation showing the Mean Response of Respondents' on the motivational level of Students taught using mastery approach**

| Male and Female gender | N | Mean | D.f | Std. Dev. |
|---|---|---|---|---|
| MALE | 47 | 17.30 | | 2.718 |
| FEMALE | 28 | 18.32 | 73 | 1.982 |

Table 4.3 Shows the mean and standard deviation of secondary school student motivational levelwhen taught with mastery approach. Mean response of male students is 17.30 and S.D 2.718, while the mean response of female students is 18.32 and S.D 1.982. The marginal mean is 17.81. Therefore the mean response of the female students is greater than that of the male students; this means that the female gender was highly motivated than the male. Though base on the marginal mean shows an increase in the difference between the male and female respectively. This finding answers research question three.

**4.3 Research hypotheses**

**4.3.1 Hypothesis One ($HO_1$)**There is no significant difference between the students taught using mastery learning and those taught using lecture method

In testing the hypothesis, t-test statistics was used in analyzing the mean response of students based on their motivational level toward the utilization of mastery approach for learning.

**Table 4.4 is the Summary of the Analysis.**

**Table 4.4: t-test Analysis of the Posttest Scores of the Experimental and Control Groups**

| Groups | N | Df | $\bar{X}$ | S.D | t.cal | p.val | Remarks |
|---|---|---|---|---|---|---|---|
| Control | 85 | | 10.41 | 2.589 | | | |
| | | 158 | | | -17.269 | 0.00 | S |
| Experimental | 75 | | 17.68 | 2.505 | | | |

S= significance P<0.05

**From Table 4.4** Shows the t-test analysis of the experimental and control groups. The mean score of the experimental group is 17.68, SD = 2.505 and df = 158. The control group has a mean score of 10.41, SD = 2.589 the t-value = -17.269 and p-value = 0.00 which is significant. On the basis of this, hypothesis one of which states that, there is no significant different between the

experimental and control groups is rejected. Hence there is a significant difference between the two groups.

**Null Hypothesis Two:** There is no significant difference between level of motivation between students taught using mastery learning approach.

The Null hypothesis is analyzed using t-test statistics and summary of the analysis is shown in Table 4.5.

**Table 4.5: t-test Pretest Scores of Male and Female Students in the Experimental Groups**

| Groups | N | Df | $\bar{X}$ | S.D | t.cal | P-val | Remarks |
|---|---|---|---|---|---|---|---|
| Male | 47 | | 17.30 | 2.718 | | | |
| | | 73 | | | -1.735 | 0.017 | S |
| Female | 28 | | 18.32 | 1.982 | | | |

S= significance P<0.05

**Table 4.5** Shows the t-test Pretest Scores of Male and Female. The mean score of the male is 17.30, SD = 2.718 and df = 73. The mean score of female is 18.32, SD = 1.982. The t-value = -1.735 and p-value = 0.017 which is significant. There is significant different between the two means. The null hypothesis that there is no significant difference in the mean scores of male and female students taught using a mastery approach is rejected. This means there is a significant difference in the achievement scores of male and female students taught using mastery approach

**Null Hypothesis 3:** There is no significant difference between level of motivation of male and female students taught using mastery learning approach.

**Table 4.6 T-test Analysis on motivational level of Students on the Utilization of mastery approach for Learningbase on gender**

| | Gender | N | Mean | Std. Dev | Df | t-value | p-value |
|---|---|---|---|---|---|---|---|
| MOT.LE VEL | Male | 47 | 3.3656 | .45077 | 73 | -0.131 | 0.917 |
| | Female | 28 | 3.3799 | .46884 | | | |

**NS= Not significant at P > 0.05 level.**

Shows the t-test Pretest Scores of Male and Female. The mean score of the male is 3.367, SD = 0.459 and df = 73. The mean score of female is 3.379, SD = 0.469. The t-value = 0.131 and p-value = 0.917 which is not significant. There is no significant different between the two means. The null hypothesis that there is no significant difference in the mean scores of male and female students taught using a mastery approach will be accepted. This means there is no significant difference in the achievement scores of male and female students taught Chemistry concepts using mastery approach.

### 4.5 Discussion of the Results

After a careful analysis of the responses of student on the questionnaire and test question administered to them, it was found that mastery approach is a good approach for students to learn and also it is interactive, creative and collaborative in nature, students will be able to learn and handle problems with their mates through the use of mastery approach better when instructors introduce mastery approach into class room to enhance teaching and learning process

The findings also suggest that mastery approach tools can be very useful for being used as educational tool. Students‘beliefs and attitudes towards mastery approach tools and its use in education are positive.

The t-test statistic for the gender analysis shows that the female gender has a higher motivational level on why mastery approach should be used in teaching and learning as the p-value was less than 0.05 level of significance. In other words, male and female secondary school students have different higher motivational level toward the utilization of mastery approach for teaching and learning.

The one way ANOVA statistic also reveals that there is a significant difference in the response of students based on their motivational level and attitude towards the utilization of mastery approach for teaching and learning. That is, the secondary school students have a positive motivational level and attitude towards the utilization of mastery approach for teaching and learning.

This finding is in support of Hargittai's (2007) findings that stressed that women were not only more likely to have used Mastery approach network than men but that they were also more likely to have used many different services, including Facebook, MySpace, and Friendster; these differences persisted in several models and analyses. Although she only surveyed students at one institution the University of Illinois at Chicago. In contrast, data collected by the Pew Internet & American Life Project found that men were more likely to have multiple Mastery approach network profiles.

Although the sample sizes of the two surveys are comparable 1,650 Internet users in the Pew survey compared with 1,060 in Hargittai's survey. The data from the Pew survey are newer and arguably more representative of the entire adult United States population.

This research is also in support of N. Zanamwe, T. Rupere, and O. Kufandirimbwa (2013) who demonstrated beyond any reasonable doubt that social networking sites are very much useful in educational settings and should be incorporated in the learning process.

# CHAPTER FIVE

# SUMMARY, CONCLUSION, AND RECOMMENDATION

## 5.0 Introduction

This chapter outlines the summary of the study, the conclusion made and the recommendations. The chapter also gives suggestions for further research.

## 5.1 Summary of the Study

The aim of this study is to investigate the impacts of mastery learning approach on senior secondary school students' achievement in chemistry, Minna Niger State. The study found out that mastery learning approach help in motivating students when they were taught chemistry, they showed a higher level of motivation and also perform more better than those that were taught with the conventional method.

On the extent of the motivational level of the student, the experimental group had a higher mean score than that of the control group, the experimental group has a mean score of 17.68 and S.d of 3.568 and the control group has a mean score of 10.41 and S.d of 2.505this shows that the experimental group that was taught using the mastery approach perform more better than the control group.For the level of motivation the students were more motivated when taught with mastery approach and the female student were more motivated than the male student. The other objective of the study was to establish the performance and level of motivation between male and female student which at the end shows that the female student at all level were more motivated and performed more than their male canter part.

## 5.2 Conclusion of the Study

There is a significant impact on the academic achievement for the chemistry student due to the method of teaching, in favor of the experimental group taught by using mastery learning

approach. This refers to the impact of mastery learning strategy on chemistry students' achievement in secondary school Chemistry.

There are statistically significant differences between the students that was taught using mastery approach and those without that the mastery approach and this can only be attributed to the teaching method, in favor of the experimental group.

There are statistically significant differences between the two group on the levelof motivation and the differences were in favor of the experimental group and the female students due to the teaching method.

**Recommendations**

In light of the results of the study, the researcher recommends the following**:**

1. Activating mastery learning approach in teaching Chemistry course because of their effectiveness in education.
2. Paying attention to students of level of performance and motivation so as to raise their academic level and take advantage of the potentials of mastery learning approach in their education.
3. The teachers should ensure that the method being employed when teaching should be the method that will raise the motivational level of the student

**5.3 Recommendations of the Study**

The following are suggestions that would be useful in policy making for the improvement of instructional resources in teaching and learning chemistry.

i. School management and administrators should improve instructional approach used in teaching and learning chemistry for example the 21st century learning students centred approaches to chemistry teachers to use in chemistry lessons.

ii. Chemistry teachers should be enlightened on the importance of utilizing mastery learning approach in teaching chemistry

iii. Chemistry teachers should be motivated in order to change the negative attitudes towards utilization of mastery learning approach.

### 5.4 Contribution to Knowledge

This study empirically establishes that:

1. Students exposed to mastery approach performed significantly higher than the students who were taught without mastery learning approach..
2. There is a significant difference in the achievements and motivational level of students taught with mastery learning approach.
3. Mastery learning approach enhances students learning ability.

### 5.5 Limitations of the Study

This study has some limitations that include the following:

1. There was limited time and facilities for the study.
2. The research work is limited to senior secondary school two (SS 2) students in chemistry in Chanchaga Local Government Area Minna.

### 5.6 Suggestions for Further Research

The following are suggestions emanating from this study:

i. This study was carried out in Chanchaga Local Government Area. Similar studies should be carried out in other Sub-Countries or entire country to find out whether similar results are obtainable.

ii. A study needs to be carried out in other private secondary and public schools to see whether findings are of a similar trend.

iii. There is need to carry out research to find out the specific areas in chemistry syllabus that are difficult or challenging (or both) to students and the teacher.

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**CHEMISTRY ACHIEVEMENT TEST(CAT)**

School: _____

Class: _____

Gender: _____

Date: _____

**INSTRUCTION: ANSWER ALL QUESTIONS**

1. during electrolysis positively charged ions move to the _____(a) Bubbles of gas (b) Positive (c) Reduction (d)Negative
2. when the structure of an electrolyte is destroyed, ions becomes_____ to move (a) (b) Free Stalk (c) Unfree (d) Constrained
3. the less of electrons in called_____ (a) Oxidation (b) Positive (c) Negative (d) Reduction
4. _____ is the positive electrode (a) Cathode (a) Plate (c) Copper (d) Anode
5. during electrolysis chemical reaction are produced at_____ (a) Reaction (b) Chemical (c) Electrodes (d) Electrolytes
6. ____ ionize slightly in solution (a) weak electrolyte (b) less (c) strong electrolyte (d) hard
7. sodium chloride is an example of _____ (a) strong electrolyte (b) non-electrolytes (c) weak electrolytes (d) none of their above
8. _____ is a compound which conducts electricity and is decomposed in the process? (a) Mass (b) Reactions (c) Electrolyte (d) Molar

9. what does the stated symbol (aq) (a) Aqua (b) Ampere (c) Aqueous (d) Solid
10. one of the following is not an electrolyte (a) Sodium chloride solution (b) Molten aluminum (c) Copper sulphate solution (d) A very concentrated sulphuric acid
11. any substance which in molten state can allow electricity to pass through is called? _____ (a) Electrolyte (b) Insulator (c) conductor (d) electric wire
12. during electrolysis, negatively charged ions move to the _____ electrodes. (a) Anodes (b) Negative (c) Cathode (c) Positive
13. ionic compounds are electrolytes when in solution but when they are in solid state they cannot conduct electricity because_____ (a) Ions are not free to move (b) They contain charged particles (c) There is free movement of ions (d) They do not contain charged
14. the gain of electron is called _____ (a) hydrogen (b) chlorine (c) oxidation (d) reduction
15. _____ relates the quantity of electricity passed and amount of substance liberated or deposited at the electrodes. (a) Law of electrolysis (b) Relative molar mass (c) Faraday's constant (d) Electrochemical series

MARKING / SCORING GUIDE FOR THE CHEMISTRY ACHIEVEMENT TEST

(two mark for each correct answer)

1. D
2. A
3. A
4. D
5. C
6. A
7. A
8. C
9. C
10. D
11. A
12. D
13. A
14. D
15. A