EFFECTS OF DEMONSTRATION AND PROJECT METHODS OF TEACHING ON SENIOR SECONDARY SCHOOL CHEMISTRY STUDENTS' ACHIEVEMENT IN MINNA MUNICIPAL, NIGER STATE.

BY

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ABSTRACT

The main determination of the study was to find out the Effects of Demonstration and Project Method of Teaching on Senior Secondary School Chemistry Students' Achievement in Minna Municipal. The problem that necessitated the study is students' low achievement in Chemistry as reported by researches. The study adopted quasi-experimental design – a non-equivalent pretest-posttest control group design. The population of the study comprised of all SSII students in Minna Municipal, Niger state. While the sample size was 107 students. The instruments used for data collection was; Chemistry Achievement Test (CAT) developed by the researcher. CAT was subjected to face and content validation by two experts from Department of Science Education, Federal University of Technology Minna. The reliability indices was found to be 0.72 Mean and standard deviation were used to provide answers for the research questions while t-test analysis was used to test the hypotheses at 0.05 level of significance. The finding showed that there was significant difference in the achievement of students taught using demonstration and project method thus. The findings of the study as presented in table 4.5 showed that there was significant differences in the achievement between male and female students taught using demonstration method. The result of the study, among others showed that demonstration teaching method increases students' achievement in Saponification concepts in Chemistry. Based on the findings of this study, the researcher, among others suggested that Chemistry teachers should endeavor to develop and adopt the use of demonstration method as it would enhance overall achievement in Chemistry as well as help reduce gender gap in the subject.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Education in general is a process used for building young ones that are illiterate about a particular concept, teaching method is designed to make students to understand the content taught therefore, if Chemistry students in Minna Municipal have achieve academically teaching methods that promote participation and skills acquisition are necessary (Ogologo & Wagbara, 2013). Since the method of presentation is so important, teachers including the pre-service teachers should be concerned not only with general methodology but also with some special methods of teaching various subjects (Ogologo & Wagbara, 2013). Teaching students to think systematically and critically about the strengths and weaknesses of different views is the ultimate aim of providing a well-rounded education. The use of teaching techniques opens many exciting possibilities for learning in a classroom.

Teaching method employed by teachers enable students to critically analyze a certain problem and is an excellent way to show two sides of a picture. Teaching methods makes students take an active part in the educational process. Teaching simply means to clearly show. Teaching with a certain method allowed the teacher to explain the details of the experiment which he performs before the students. The student's also finds it easy to grasp as they not only see the things with their eyes, but also hear their detailed explanation from the teacher. Teaching require an active participation of students. Teaching method is a strategy that helps in the building of people's moral and it contribute to the well-being of the nation, inability of teachers to adopt the right teaching method may impede students learning outcomes. Education has brought the rebuilding of human mindset in the environment. It has been discovered that prevailing

teaching methods predominantly employed by secondary school teachers at secondary school level in Nigeria is the teacher-centred, involving showing, telling and observing (Agharuwhe & Ogborubo 2010). Ideally, an effective method of teaching Chemistry subject must integrate the nature of the subject into it, with the mode of strength of the knowledge, theory, practice, and models used. By this, students are made to participate both mentally and practically in the teaching and learning activities in the class or laboratory (Idoko C.U (2014). In view of the foregoing, Akinbobola & Ikitde (2011) outlined those criteria that should be considered in selecting method namely the age of pupils, level, class, student's background, school location among others. In continuation, Akinbobola & Ikitde (2011) asserted that there are different teaching methods that can be used to enhance students' achievement in chemistry in senior secondary schools and one of such methods is Demonstration method.

Demonstration method is a method of teaching concepts, principles of real things by combining explanation with handling or manipulation of real things, materials or equipment (Akinbobola & Ikitde 2011). Demonstration teaching method means teaching by presenting reason or proof, explaining or making clear by use of examples or experiment (Ogologo&Wagbara, 2013) Demonstration allow the teacher to explain by the details of the experiments that he has performed before the students. Demonstration teaching approach involves method of teaching concepts, principles or real things by combining explanation with handling or manipulation of real things, equipment or materials. It also involves showing by reason or proof, explaining or making clear by use of examples or experiments. Demonstration method enhances the degree of participation and sensory involvement by the learner during the demonstration. Demonstration approach can bridge the gap between theory and practice, controls the rate of breakages of tools and equipment, and accidents as students watch

the teacher do it before attempting to do the same. It is learning by doing approach and so enables the teacher to teach manipulative and operational skills within a short time using little material. So, this research intended to further examine effects of project and demonstration teaching approaches on Chemistry students' skills acquisition. Demonstration method is no substitute for laboratory exercise or for learning proper techniques of handling laboratory equipment, but are effective means of supplementing and clarifying the material being taught. (Edu, Etelbert & Idaka, 2012). Demonstrations in science encourage generalization because they promote active involvement by students and also enhance students' attention level. It may also be beneficial to include elements of cooperative learning in demonstration lessons, in order to improve students' understanding of what is taught (Eilks, Prins & Lazarowitz, 2013).

Demonstrations method as a teaching strategy will helps students to understand the subject of Industrial chemistry (saponification) concept in Chemistry better. Exposure to demonstrations improves students' perceptions of their learning efficiency and the importance of the subject and also enhances the students' achievements and their understanding of saponification concepts (Sweder & Jeffery, 2013). Demonstrations, if planned properly, and if they are effectively integrated into the learning of concepts, have potential to play an important role in students developing a deep and rich understanding of saponification concepts in Chemistry. Experiments and demonstrations that confirm a physicochemical phenomenon such as illustrating chemical processes by light-sticks (Kuntzleman, Rohrer and Schultz, 2012) can be used to facilitate understanding certain industrial chemical concepts, for example, saponification. Although demonstrations have been conducted in chemistry classrooms for a long time, little research exists that documents the frequency that such

demonstrations are employed or their effect on learners' motivation and performance (Price & Brooks, 2012; Odom & Bell, 2015).

Demonstration is used for teaching students to acquire skills. It involves showing students how to carry out a practice or use a tool/implement. Here, students are taught specific skill, techniques required for it uses and procedure involved in carrying out the skill. Olatoye and Adekoya (2011) state the examples of method demonstration as how to use a sprayer, different planting methods, fertilizer application, seed treatment; and different methods of pests and disease control. The teacher has to pay attention to all safety rules, precautions and procedures; and emphasis them to the students. Use proper instructions, aids such as chalkboard, charts, handouts etc. to support the demonstration. Provide for trainee's participation where possible, during and after demonstration. In demonstrate, first impressions are important, therefore, always summarize the steps, emphasis and key points again. After demonstration, return all items used during demonstration to their storage places, make arrangements to have the trainees practice the skill as soon as possible in a practical class session, observe and analyze trainee(s) performance and correct mistakes, offer reinforcement where necessary, coach weak or slow trainees, check trainee's completed work for accurate performance and record and allow sufficient time interval before demonstrating another operation (Ogologo & Wagbara, 2013). Another method that can be effective in teaching saponification concept in chemistry is project method.

Project teaching approach facilitates students' skill acquisition (Udofia& Aniefiok, 2013). Udofia and Aniefiok (2013) stated that project method can be carried out by creating the proper situation for the students by the teacher in the class. The teacher puts up the knowledge about the project procedure, steps, and uses to the students. A project should arise out of a need felt by students and it should never be

forced on them. It should be purposeful and significant. The teacher helps the students to select the problem and guides them in solving the problem. Students have freedom to choose the topic or problem based on their interest and ability. Before choosing the topic the principles should be taken into an account; school tasks should be real and purposeful in a nature that the student is genuinely eager to carry them out in order to achieve a desirable and clearly realized aim. The teacher should only rouse the students for a particular project by providing a situation but the proposal for the project should finally come from students.

Project method encourages students to search for relevant knowledge rather than the lecturer monopolizing the transmission of information to the learners (Ganyaupfu, 2013). Projects are described as having a complex but flexible structural framework with features that characterize the teaching-learning interaction depending largely on instructional methods. Project method is one of the instructional methods used by vocational and technical instructors as it enables students' participation and fast acquisition of skills (Edu, Ayang &Idaka, 2012). Project approach seems to have the components to motivate teachers and students to develop a cooperative work mainly aiming at the students to perceive and understand all the necessary stages required to arrive at logical conclusion. Research shows that learners do not only respond by giving useful information, but they also actively use what they know to explore, negotiate, interpret and create. Education has benefited from this teaching approach, as teachers have learned how to effectively select content and activities to amplify and extend the skills and capabilities of students and also enhance student's achievement. (Edu*et al.* 2012).

Academic achievement as stated by Wikipedia encyclopedia is the outcome of education, the extent to which a student, teacher or institution has achieved their

educational goals. Academic achievement is commonly measured by examinations or continuous assessment. According to Wikipedia encyclopedia Individual differences in academic achievement have been linked to differences in intelligence and personality. Students with higher mental ability as demonstrated by IQ tests and those who are higher in conscientiousness tend to achieve highly in academic settings. Carmen (2001) define achievement basically as the competence a person has in an area of content. This competence is the result of many intellectual and non-intellectual variables. Educationally, achievement may be defined as the mastering of major concepts and principles, important facts and propositions, skills, strategic knowledge and integration of knowledge (Niemi, 1999). More systematically, achievement is sometimes fractionated into knowledge components (Ruiz-Primo, 1998), like declarative, procedural and strategic. It is believed that in Chemistry the paramount thing in teaching and learning is students' achievement and that make them functional in the society, as such students' achievement in Chemistry should be given top most priority.

Gender is another factor to consider in students learning. Social economic status is an important factor when considering students' achievement. Girls' orientation towards science is more positive in relation to boys in disadvantaged communities where as boy's orientation towards science is more positive in upper middle class communities (Kotte, 1992). The findings that girls have more positive attitudes than boys in disadvantaged communities, has implications that girls have more experiences than boys do in this communities. Attitudinal orientations are likely to vary with age. Boys more positive attitudes towards science at adolescence may reflect attempts by both boys and girls to conform to traditional stereotypes of science as masculine domain which is capable of capturing the interest of boys not so much of girls (Keeves, 1973). The sex difference could be a function of changes in learning climate that occur in

schools. Girl's function less well with the discovery approach often used in science classes; they prefer verbal information in discovery situations.

The most promising intellectual factor that has influence and may partially explain the male's superior performance in chemistry is spatial ability. Student's ability in chemistry concept continues to be the intellectual area in which the strongest and most consistent significant sex differences are found (Haertel et al, 1981). However, the differences are small and many times, variation among girls or boys is greater than the variation between sexes. Though small, there is consensus that there is male superiority in performance on such tasks. According to research, there is a strong relationship between visual-spatial ability and success in science. According to Kelly (1978), when 3-dimentional models were used in teaching general chemistry, final grades improved. Levy and Levy (1978) report that visualization and spatial orientation skills are significantly correlated with final grades in engineering courses since sex-related differences in spatial ability favor boys, this factor gives males and advantage in the study of science, especially in the physical sciences. Girls showed weakness across the framework on questions featuring spatial related ability. Such questions included rotational motion, angles, 2 or 3 – dimensional reproduction or interpretation and graphical skills.

1.1 Statement of the Research Problem

Despite the effort made by Chemistry teacher in simplifying teaching and learning of practical chemistry by utilizing and improvising instructional materials in senior secondary schools, yet it appears as if student's achievement is on a low side. This trend may be attributed to students seeing Chemistry as difficult, uninteresting and confusing due to the involvement of practical in the concept of Saponification in Chemistry. Lending to this (Joe and Okoto 2014) stated that this poor performance of

students hinges on the fact that there is not enough competent Chemistry Teachers and some teachers don't use appropriate method and instructional material during teaching and learning of Chemistry in the class. However, the research is motivated to carry out this study to ascertain which teaching method could enhance achievement in saponification concept in Chemistry. However, looking at this reoccurring trend, one could ask what is the cause of this poor performance in chemistry concept? Could it be that teachers are not using the appropriate method of teaching? It is therefore, the intention of the researcher to put an end to this poor performance of students by carefully investigating the use of demonstration and project teaching method in the teaching of saponification concept in Chemistry subject in Niger state. This is the gap the researcher wants to fill in this study. It is against this backdrop that the researcher investigates the effect of demonstration method and project method to discover the one that will improve student's achievement.

1.3 Aim and Objective of the Study

This research aims to find out the effects of demonstration and project teaching method on senior secondary school Chemistry students' achievement in Minna Municipal Niger State. Specifically, the study objectives are to determine:

1. Mean achievement scores of students exposed to demonstration and project method of teaching Saponification concept in Chemistry.
2. Influence of gender on students' achievement in Chemistry taught with demonstration teaching method.
3. Influence of gender on students' achievement in Chemistry taught with project teaching method.

1.4 Research Questions

1. What are the mean achievement scores of students exposed to demonstration and project teaching method in saponification concept in Chemistry?
2. What is the influence of gender on the mean achievement scores of male and female students exposed to demonstration teaching method in saponification concept in Chemistry?
3. What is the influence of gender on the mean achievement scores of male and female students exposed to project teaching method in saponification concept in Chemistry?

1.5 Research Hypotheses

The following hypotheses were formulated for the study;

$H0_1$: There is no significant difference in the mean achievement scores of the students exposed to demonstration and Project teaching method in saponification concept in Chemistry.

$H0_2$: There is no significant difference in the mean achievement scores of male and female students exposed to demonstration in saponification concept in Chemistry.

$H0_3$: There is no significant difference in the mean achievement score of male and female students exposed to Project teaching method in saponification concept in Chemistry.

1.6 Scope of the Study

This research work is aimed at investigating effects of demonstration and project teaching methods used in the teaching of Saponification concept in chemistry in

secondary schools in Niger state.The study is limited to two secondary schools in Minna Municipal. The content of the study is Saponification concept in Chemistry. The reason for the choice of this concept (saponification) is due to the abstract nature of teaching Chemistry subject in Minna Municipal.

1.7 Significance of the Study

At the comprehension of this study, the findings of this study will be of benefit to students, teacher's parent, and Education administration among others. Demonstration and Project as a teaching method plays a very significant role in the education system. It is hopeful that the findings of this study will benefit student by making them productive in the society after school. With this methods of teaching, student don't have to be idle, but instead of being idle they make use of what they have been taught in the class during their school time. Also if the teachers implement the recommendation made as a result of using demonstration and project method in teaching chemistry concept, it will help solve the situation of poor performance of students in Chemistry examination in Niger state. The findings of this study will benefit parents in the sense that they will know the best methods in teaching chemistry concepts. Again, findings of this research would enable the educational planners and school heads to read just their method mapped out in teaching Chemistry. This research work will serve also as a guideline for other researchers that intend to carry out research work on topics associated or related to it. Above all, this research work will stand the test of time and equally as a reference point to the students of Science.

1.8 Operational Definition of Terms

- **Achievement:** The act of accomplishing something, a result of a hard work done by students, the benefit of student's work and the benefit of effort put to

something. It a successful performance of someone, an award for completing a particular task or meeting an objective.

- **Chemistry:** The branch of natural science that deals with the composition and constituent of substance and the changes they undergo as a consequence of alterations in the constitution of their molecules
- **Demonstration Method:** Demonstration is process of teaching *stu*dents using verbal and practical illustration of a given procedure, it contains achieve participation of students, it *is use* for developing long-term memory retention. Demonstration makes student to easily grasp thing with viewing what teacher practically to them. Principles of real things by combining explanation with handling or manipulation of real things, materials or equipment.
- **Project Method**: This a process whereby teacher gave student problem to solve on their own allocating time to them for submission. Project method that is a planned endeavor with a specific goal and having several step or stage, for further understanding the topics.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Framework

Chemistry is a branch of science that deals with study of nature and properties of all forms of matter and the various changes that these substances undergo in different conditions. Chemistry is the scientific study of the structure of substances, how they react when combine with one another, and how they behave under different condition. Chemistry is the branch of science that deals with the study of the composition and properties of matter, changes in matter, the laws and the principles that govern these changes (Ebbing, 1996) It is an important part of what is called science and an active and continually growing science that has vital importance to our world in both the realm of nature and realm of society (Anaso, 2010). According to Kauffman and Szmant (1987), Chemistry is characterized as the most utilitarian of all the experimental sciences. For example, in Kenya, a good secondary school education pass grade in chemistry is a prerequisite for joining medical and agricultural professional courses. Poor performance in the subject means fewer students are able to join such professions, therefore lack of enough professionals leading to low health care provision and food insecurity in the country.

Since chemistry is the science that has the most direct and dramatic impact on our lives, and the science that shapes the world we will live in tomorrow, the performance of students in the subject is a major concern to any developing country (Khan, Hussain, Ali, Majoka, and Ramzan, 2011). The uniqueness of chemistry and the

central role that it stands to play in the development of any nation when considered, are however, not evident in the performance of students. The students‟ performance in chemistry in Nigeria has been poor and unimpressive (Anaso, 2010).

Anaso (2010) reports that researchers had observed that lack of chemistry practical's by Chemistry students‟ results in poor communication as well as observational skills; this gives rise to students‟ poor performance. Also, good quality chemistry practical's helps in developing students‟ understanding of scientific processes and concepts (Dillon, 2008), hence the heavy investment made in the provision and equipping of chemistry laboratories in secondary schools.

2.1.1 Concept of Teaching Method

Several teaching methods have been in use for years. These methods range from lecture, discussion, field trips, project, demonstration, laboratory, expository, discovery, concept mapping etc. The extent to which one or a combination of these is used poses much concern to educators as to the possible outcomes and the ultimate realization of the objectives of education. Methodology is very vital in any teaching learning situation. It is often maintained that the method adopted by the teacher may promote or hinder learning. It may sharpen mental activities or it may discourage initiative and curiosity.However, there are so many teaching methods that can be used in teaching chemistry which include:

Demonstration Method

According to Wikipedia encyclopedia demonstration involves showing by reason or proof, explaining or making clear by use of examples or experiments. Put more simply, demonstration means to clearly show. Demonstrations often occur when students have a hard time connecting theories to actual practice or when students are unable to understand application of theories. There are various methods of teaching and the

choice of teaching method(s) to use is affected by many variables such as content, time, ability of pupils, group size as well as the teachers‟ personal preference (Andrusyzyn as cited by Chingombe 2013) Mutasa and Wills as quoted by Chingombe (2013), propound that the demonstration method involves the teacher showing pupils how to do something while they observe. Pupils‟ practice will follow the teachers“demonstrations. According to Chamberlain and Kelly (1981) demonstrations are used to show procedures and to explain techniques. Thus, demonstration is a direct means of explaining things to the pupils. Chikuni (2003) also states that demonstration is where the teacher shows how something is done by actually doing it. According to Child as cited by Chingombe (2013), a child learns better through imitating. Kudu and Tutooas cited by Chingombe (2013) concur with Child when they state that Bandurasbobo doll experiment showed that children learn through imitation. In support of this, Hendrik as cited by Chingombe (2013) figured out that children learn vicariously through emulation. Therefore, the demonstrations ought to be done correctly for pupils to copy the correct ways of doing things. For Gwarinda as cited by Chingombe (2013), demonstration method enhances translation of theory into practice. Soroka, Hoagland and Mohale as cited by Chingombe (2013) propound that the demonstration method should be used to impart skills. That is why this method is often applied in the teaching and learning of practical subjects. Gwarinda as cited by Chingombe (2013) concurs that demonstration involves teaching pupils how a specific skill is executed.

This method is recommended for teaching a skill because it enables covering of all the necessary steps in a process (Petty as cited by Chingombe (2013). Thus, the demonstration method gives pupils the opportunity to see and hear the related details being taught. These details include the necessary background knowledge, steps or procedures precautions (McKeachie as cited by Chingombe 2013). The demonstration

gives pupils the opportunity to become proficient. In short, this method is recommended because it leaves nothing to chance. Various demonstration techniques are used to impart skills to learners. Such includes:

Lecture method

In the words of Akunya (2006), lecture method is a method in which the teacher tells the students what he/she knows of the subject matter. Akunya believes that the learner is almost blank and the teacher dishes out what he knows to his/her students by means of dictation or reading out his notes. Ali (1998) defined lecture method as a method of teaching which involves the teacher telling the students what he thinks the need to know and the students listening and copying what they think the teacher needs them to know. Thus, lecturing involves the teacher's talking and the students listening and copying what the teacher is talking into their note. Ali (1998) also described lecture as "Chalk and Talk" teaching approach and also "the process whereby the teacher's notes are transferred from his note book to those of his students without passing through the minds of either". In the opinion of Maduabum (1989), lecture method is a teacher centered approach involving largely a one-way form of communication from teacher to students. For this reason, it is termed as a didactic approach. The teacher as the authority-figure, does most of the talking with the students as passive recipient of information listening and writing down a few notes and asking questions. Lecture method according Gbamanja (1991) is a traditional didactic approach to teaching. It is a teaching technique in which one person, normally the teacher, presents a verbal discourse on a particular subject theme, or concept to the learners. It is sometimes referred to a 'Chalk and Talk', verbal exposition or textbook method.

Discussion Method

The discussion method is a method that involves verbal exchange of views, opinions or ideas between two or more people (Bakke, 2004).

According to Imoko (2004), discussion method involves interchanging of ideas, questions and answers among students primarily. It connotes give-and-take between teacher and students and among the students themselves. Discussion is seen as a method that essentially embodies the basic properties of the democratic process. It assumes that individuals when sufficiently informed on an issue are capable of making decisions. Discussion according to Akunya involves interaction among teacher-students in a classroom. Discussion method involves probing, investigating and exploration of ideas, concepts and issue in the class. It is a part of an intellectual dialogue between the student and the teacher in a classroom interaction. It is a method of teaching when learners participate in questioning, sharing, differing, conjecturing, and problem-solving and decision. (Akunya, 2006) Gbamanja (1991) stated that a discussion occurs when two or more people interact verbally with each other and that it becomes more meaningful if the persons involved are able to harmonize their ideas to arrive at a consensus. According to Onah, (2008), discussion approach to teaching can enrich various types of teaching methods. Discussion at brief intervals to clarify certain points must be adopted during lecture, inquiry, and discovery or even before and after excursion or laboratory exercise. It is therefore more of a technique in teaching used to enhance effectiveness of various teaching methods.

Discovery Method

The discovery method is a method by which the learner is allowed to find out some things. It involves him in search to find the truth and facts of a given topic or subject. It provides learners with opportunities to discover new truths, new rules or formulas, new method of tackling problems, as well as new values for themselves.

This method, also called the guided discovery method, is not easily carried out by the teacher but it gives joy when successful. (Akunya, 2006) Discovery method, according to Maduabum (1989) is a teaching approach in which the learner has to figure thing out. Maduabum continued saying that some education advocates offering some guidance to the learner, favour leaving the alone unaided in discovery learning.

Project Method

This method is also called the activity method or the method of learning by doing. Activity or project method is a teaching method which assumes that students find interest, derive enjoyment, and learn best by doing a piece of work. The method introduces elements of joy into an uninteresting part of class work (Akunya, 2006). It is a method that enables the students in a class to be usefully active throughout the whole lesson period. By being involved in caring out activity, the student is at the same time learning the skill. Akunya went ahead to state that project method could be physical or mental and a means to learning not as an end I itself. The project or activity method permits work in a classroom to be carried out in a friendly manner with the teacher as the motivating spirit and the students gladly doing most of the work. Learning is controlled, aided, directed co-operatively by learners. In the words of Gbamanja (1991) the project method is a form of individualized instruction whereby the learner performs a unit of work in a natural manner and in a spirit of purpose to accomplish a definite goal. The project is a learning unit that requires creativity and originality of experiences by students. Project teaching method according to Ali (2006) is a method in which students engage in long-term assignment to complement the regularly scheduled work. To Ali activities in the project work are meant to serve as means of motivating and sustaining learners' in their school work. In the views of Akunya (2006), the project method may be in any of the following forms-laboratory and assignment methods. This

gives students the opportunity of doing it themselves and consequently could develop students' achievement in the subject matter under consideration.

The Socratic Method.

The Socratic Method was introduced by the Greek philosopher, Socrates, hence the name. It's a sequence of suitable questions and related answers. The method demands that the teacher skillfully questions the learners and by so doing makes them not only to doubt but also to abandon the statement for a more adequate one**.** According to the Wikipedia encyclopedia, the Socratic Method (also known as Socratic method), named after the classical Greek philosopher Socrates, is a form of inquiry and debate between individuals with opposing viewpoints based on asking and answering questions to stimulate critical thinking and to illuminate ideas. It is a dialectical method, often involving an oppositional discussion in which the defense of one point of view is pitted against the defense of another; one participant may lead another to contradict himself in some way, thus strengthening the inquirer's own point. The Socratic Method is a negative method of hypothesis elimination, in that better hypotheses are found by steadily identifying and eliminating those that lead to contradictions. The Socratic Method searches for general, commonly held truths that shape opinion, and scrutinizes them to determine their consistency with other beliefs.

The basic form is a series of questions formulated as tests of logic and fact intended to help a person or group discover their beliefs about some topic, exploring the definitions or logoi (singular logos), seeking to characterize the general characteristics shared by various particular instances. The extent, to which this method is employed to bring out definitions implicit in the interlocutors' beliefs, or to help them further their understanding, is called the method of maieutic. Aristotle attributed to Socratesthe

discovery of the method of definition and induction, which he regarded as the essence of the scientific method.

Problem Solving Method:

In the words of Akunya (2006), the problem solving method is related to the discovering method. When an individual is confronted with a problem, usually, he or she always endeavors to find a solution to it. Attempts to solve problems lead to the discovery of new facts which add to the growth of knowledge.

Remedial Method:

Remedial teaching employed in the present study is the one that is practice at Samveda Research and Training Centre. This method is referred to as SRTM-Math (Samveda Remedial Teaching Model-Math) in this paper. The SRTM-Math follows the following sequence:

1. Error analysis,
2. Developing Conceptual Base,
3. Developing Language Component,
4. Mastery learning and Instructional Techniques,
5. Teaching Fundamental Math,
6. Teaching Interface Math and
7. Teaching Parallel Text.

The first four components are given priority before initiating specific remediation in Math.Fundamental math deals with Arithmetic, Algebra and Geometry. This paper deals with only the teaching of fundamental arithmetic. Algebra and geometry are outside the purview of the present study

Another method that is equally useful in teaching economics is the remedial method. This method according to Akunya (2006) is used by teachers to remove common weakness among their students. It means that part or the teaching period should be set aside for the correction of class written work. The teacher should draw the attention of the students involved

Excursion method:

Another method that has been useful in teaching of economics is the excursion method. This method involves going out or making a trip or journey to the site of the object of attraction or interest for detailed analysis. It Involves an on the spot assessment of the object under discussion. It is a system through which in the field of education both the learner and the teacher are engaged in an outdoor activity to fulfil the designed objective. It is one of the ways some lessons in economics can be properly taught without relying so much on textbook information, (Akunya, 2006). Excursion method of teaching provides an opportunity to learners to visit different places across the world for their academic enhancement. Main features and purposes of this method are elaborated briefly. Types of excursion and its steps involved in this method are explained. Authors also explain the major characteristics of excursion method of teaching including with its merits and limitations. Finally, the major precautions of excursion method of teaching and some suggested excursions are briefly discussed in this article. Experiences can be gain by sensory organs. Children and adults inspire by visual and sensory experiences to enhance their knowledge. In the early childhood period there are huge opportunities to expose children for acquiring new experiences through excursions being one method. Field trip, tour are the synonyms of excursion. Lucy Mitchell, a pioneer thinker of early childhood education considered field trips should be a vital part of the social studies program. Children have the opportunity to experience real life from outside the

classroom with their teachers, peers or family. Through taking a trip child can observe social systems and the different roles such as fire and police protection, traffic control, banking, shopping and other relative systems can understand easily. Excursions also provide children with first hand experiences in which they can develop further in language and literacy, gaining new vocabulary and problem-solving skills. The involvement of parents and related family members can encourage children to have weekend trip to nearest visiting places. In the early childhood setting, an excursion needs to be well planned for travel, meals, written permission, water arrangement, medicine kit etc. for the day. A carefully planned trip will result in benefits to learn about the world around them. Children's learning and development are enhanced through direct interaction with not only the Man-made world around them, but the natural world too. It reminds us to ensure our visits for establishing a lifelong love and enjoyment of our natural world. Being in contact with the natural world develops a love of nature and children can truly learn to become caretakers and nurturers of our environment. Children can become social and environmental problem solvers by developing values of co-operation and sharing responsibility to each other's.

2.1.2 Teacher's Characteristics and performance in Chemistry

Teachers, play an important role in teaching science no one will doubt their influence on their student's acquisition of knowledge. Just how teachers and the way they teach chemistry affects the generation, constitution or reduction of gender differences in Chemistry achievement has to be considered. Knowledgeable teachers are less likely to pass on misconceptions, are more confident in imparting information, use less time for preparation, and are able to present a wider range of examples and analogies which may help students to learn and understand a certain topic more easily. Only in some cases does teaching experience produce higher science achievements.

Differences have been shown between male and female teachers with respect to their classroom behavior, expectations of achievement of students, or teaching behavior. If teachers tend to show gender – stereotypical behaviors in the classroom, one would probably see this as an effect of the science teacher being male or female, thereby following his or her own gender-typical role in teaching there is no empirical evidence that female science teachers produce better results with girls. In fact more secondary school science teachers were found to be male.

2.1.3 Concept of Practical in Chemistry Learning

The quality of chemistry practical varies considerably around the world (Lunetta, Hofstein & Clough, 2007). Most curricula specify that practical and investigative activities must be carried out by students. However, there is a gap between policy and practice, between what is written in curriculum documents, what teachers say they do, and what students actually experience. Hodson (2001) found that the lesson objectives stated by teachers frequently failed to be addressed during actual lessons.

Despite curriculum reforms aimed at improving the quality of chemistry practical, students spend too much time following recipes and, consequently, practicing lower level skills (Dillon, 2008). Similarly, where students only carry out instructions from worksheets to complete a practical activity, they are limited in the ways they can contribute. As a result, students fail to perceive the conceptual and procedural understandings that were the teachers‟ intended goals for the laboratory activities (Lunetta*et al.*, 2007). This is a case of utilization of the opportunities provided by practical activities. If teachers do not select appropriate chemistry practical, this may end up in laboratory work of doubtful quality. Such an approach is de-motivating for students and a poor use of teaching and learning resources and which may end up contributing to poor performance in the subject.

2.1.4 Importance of Demonstration Method in Education

Ameh and Dautani (2012) carried out experiment on effect of lecture and demonstration method on the academic achievement of students in chemistry in Nassarawa local government Area of Kano State. The sample of the Study was fifty-eight (58) chemistry students in senior secondary one (SS1) from two randomly selected school. The hypothesis was tested and the findings of the study shows; that students performed better in chemistry when taught using demonstration method as compared to the lecture method group. that the male students are better in academic achievement when taught with demonstration method than when taught using lecture method, that the female students achieve higher when taught with lecture method than when taught with demonstration method. These studies looked at demonstration method of teaching in Agricultural science and chemistry as yielding positive results, therefore it would be imperative to empirically ascertain what the outcome would be when used in Saponification concepts in Chemistry.

The study Maizuwo (2011) carry out investigated the effectiveness of demonstration teaching method on students' misconceptions of concept in organic chemistry and academic achievement of chemistry students. He has reported that there is a significant difference in academic achievement of students when exposed to Demonstration Teaching Strategy which implies that Demonstration Teaching Strategy is an effective Teaching Strategy. At the end of the study it was concluded that the students taught with the demonstration method were found to have high achievement score in the Chemistry students' achievement Test (CSAT) and their counterparts in the control group that were taught with the discussion method. Daluba (2013) carried out an experiment on effect of demonstration method of teaching on students' achievement in Agricultural science. The study was carried out using one hundred and ninety-five (195)

senior secondary three (SS3) students in Kogi State. At the end of the study it was concluded that the students taught with the demonstration method were found to have high achievement score in the agricultural students' achievement Test (ASAT) than their counterparts in the control group that were taught with the conventional lecture method. Unfavorable classroom environment can discourage learners and they become less willing to learn invariably affecting their interest in classroom activities. Interest as a psychological construct plays a major role in various life activities including academic. The decision to engage or not to engage in an activity, desire to persist or even to re-engage after disengagement and the degree of effort and time put into an activity are mainly dictated by the level of interest in the individual.

2.1.5 Disadvantages of Employing Demonstration Method in Education

Some school don't employ this method because they lack tools, equipment needed for the demonstration during the teaching. This makes students not to get advantages from the experiment conducted using this method when teaching. Demonstration teaching method cannot be used without the necessary instruction material needed in teaching, using this method required schools to look at each syllabus in order to know what they need to buy, for experimentation aspect. Looking the nation at large the budget Education ministry are not well used, the wrong use of the money budget for education, affect demonstration teaching method in secondary schools. Absence of equipment for demonstration demotivate teachers in using this method to teach. Teachers looked at the following demerit before using demonstration teaching method: It is not possible to impact information of all the topics included in the syllabus through this method. Generally, numbers of students in the classroom are found to be large as a result of which majority of them fail to get advantage from the experiment conducted this method. As number of students is found to be very large in the

classroom, thus all the students do not get opportunity to play an active role in learning process and large number of them cannot touch the apparatus, which are used by the teacher. It is found that pace at which experiments are conducted by the teachers in the classrooms are very high as a result of which large number of students fails to understand the information provided by them. It will be unjust to blame the teacher for conducting experiments on such fast pace, as they also have limited period of time for this purpose.

2.1.6 Demerit of Project Method of Teaching

Researchers have shown that behind the advantages possessed by Project method, of course, there also found many deficiencies in the implementation affecting the success of Project teaching method, especially when implementing project based learning approach in a large class. Although generally Project teaching method can increase students' motivation, but many researchers revealed that if the Project teaching method is applied in large classes, teachers experience difficulty in improving students' motivation, difficulty in making the students to concentrate on learning tasks, difficulty in facilitating students to connect new content with their prior knowledge, and difficulty in performing cooperative learning activities efficiently. Other disadvantages encountered in the implementation of Project method are as follows.

Project teaching method requires a lot of time that must be provided to solve complex problems (Grant, 2002). This will lead to a lack of time available for the material and content.

Many parents of students who feel aggrieved, because it adds to the cost of entering the new system. Many instructors or teachers feel comfortable with traditional classroom, where the instructor or teacher play a central role in the classroom. This is a difficult transition, especially for instructors or teachers who have little or no control of

the technology (Scott, 1994). Applying project based learning in the classroom may be intimidating for some experienced teachers and will be even worse for beginners (Grant, 2002). The amount of equipment to be provided, so that the demand for electricity increases. Almost all instances of successful project based learning capitalize on the success of cooperative or collaborative learning. Students who have a weakness in the experiment and the collection of information will have trouble. Students who are not knowledgeable with working in groups may have difficulty in cooperation and compromise. If this method has not been used before, it may be necessary to teach students how to interact in a group and manage conflict within the group. There is a possibility of students who are less active in group work. When the topic given to each group is different, it is feared that students cannot understand the topic entirely. For a self-assessment survey, the data may have been influenced by a small inconsistency. Lack of student achievement in the subject, including methods of teaching. By referring to the deficiencies in the implementation of Project teaching method, those can be minimized by the use of other teaching method in the learning process, and it would be more interesting if the classroom atmosphere is not monotonous.

2.2 Theoretical Framework

2.2.1 Cognitive Load Theory

This study was anchored on cognitive Load theory. The following was propounded by John Sweller in 1988. The theory suggests that learning happens best under conditions that are aligned with human cognitive architecture. The structure of human cognitive architecture, while not known precisely is discernible through the results of experimental research. Sweller built a theory that threats schemas, or combinations of structures that make up an individual's knowledge base. Schemas are acquired over a lifetime of learning, and may have other schemas contained within themselves. The

theory explained that learning requires a change in the schematic structures of long term memory and is demonstrated by performance that progress from Clumsy, error-prove, slow and difficult to smooth and effortless. The change in performance occurs because as the learner becomes increasingly familiar with the materials, the cognitive characteristics associated with the material are altered so that it can be handled more efficiently by working memory. From an instructional perspective, information contained in instructional material must first be processed by working memory. For schema acquisition to occur, instruction should be designed to reduce working memory load. Cognitive load theory is concerned with techniques for reducing working memory in other to facilitate the changes in long term memory associated with schema acquisition.

Sweller's cognitive load theory is best applied in the area of instructional design of cognitively complex or technically challenging materials. His concentration is on the reasons that people have difficulty learning materials of this nature. Cognitive load theory has many implications in the design of learning materials which must, if they are to be effective, keep cognitive load of learners at a minimum during the learning process.

Specific recommendations relative to the design of instructional material include:

1. Change problem solving methods to avoid means-ends approaches that impose a heavy working memory load, by using goal-free problems or worked examples.
2. Eliminate the working memory capacity to integrate several source of information.
3. Eliminate the working memory load associated with unnecessarily processing repetitive information by reducing redundancy.

4. Increase working memory capacity by using auditory as well as visual information under conditions where both sources of information are essential (i.e. non-redundant) to understanding.

This theory is related to the study under consideration in Chemistry are complex or technically challenging materials to the secondary school students. The theory stands the ground to proffer solution on how to design instructions in the classroom in a way that will help to bring about proper understanding when students are exposed complex or technically challenging materials.

2.2.2 Ausubel's Theory of Learning

This study was anchored on Ausubel' theory of learning. David Ausubel in 1960, developed Ausubel's theory of meaningful learning; said is a theory which stressed the importance of prior knowledge. This theory for learning contrast with rote learning which is only good for memorization and regurgitation of facts. The specific emphasis of the Ausubel's theory stresses that meaningful learning of new knowledge is dependent on what is already known. Specifically, new knowledge gains meaning when it can be substantively related to a framework of existing knowledge rather than being processed and filed in isolation. Ausubel theory provides the basis for constructing concepts map which support the visualization of such conceptual frameworks and stimulate prior knowledge by making it explicit and requires the learner to pay attention to the relationship between concepts. Ausubel's assimilation theory of learning promotes the idea that people learn better if they can find meaning in the learning. Ausubel also maintains that concepts are of different depth which ranges from general to specific. A general concept subsumes less general concepts which also include most specific concepts. Ausubel posits that concepts can be progressively differentiated by the level of specificity Ausubel believes that learning of new knowledge relies on what

is already known, that is construction of knowledge begins with observation and recognition of events and objects through concept already stressed. He went further to say that we learn by contracting a network of concepts and to adding them. In this theory, concept map, developed by Ausubel and Novak, is an instructional device that uses this aspect of the theory to allow instruction of materials to learners; it is a way of representing relationship between ideas, images or words. Ausubel equally stressed the importance of reception rather than discovery and meaningful learning rather than rote learning. He declares that his theory applies only to reception learning in school settings. He didn't say, however, that discovery learning does not work; but rather it was efficient Ausubel's theory emphasized more on meaningful learning and that new knowledge gains meaning when it can be substantively related to framework of existing knowledge rather than being processed or filed. David Ausubel's theory of leaning is applied in the use of organizers and concept mapping. Ausubel believes that knowledge is hierchically organized; that new information is meaningful to the extent that it is related to what is already known. Ausubel advocates the use of advance organizers as a mechanism to help link new learning materials with existing related ideas. Ausubel's theory of advanced organizers fall in two categories: comparative organizers and expository organizers. Comparative organizers activate existing schemas and are used as a reminder to bring into working memory of what you may not realize is relevant. Comparative organizers are also used to integrate as well as to discriminate. Expository organizers are often used when the new learning materials is unfamiliar to the learner. They often relate what the learner already knows with the new and unfamiliar material: this in turn is aimed to make the unfamiliar material more plausible to the learner. Ausubel believes that construction of knowledge begins with our observation and recognition of Events and objects through concepts we already have. We learn by

constructing a network of concepts and adding to them. Concept map is an instructional device that uses this aspect of the theory to allow instruction of material to learners: it is a way of representing relationships between ideas, images and words. As Such this research work resort to investigate how concepts represented graphically in the form of concept mapping could contribute to meaningful learning.

2.3 Review of Related Empirical Studies

2.3.1 Demonstration Strategy in Education

Ameh & Dautani (2012) carried out experiment on the academic achievement of students in chemistry in Nassarawa local government Area of Kano State. The sample of the Study was fifty-eight (58) chemistry students in senior secondary one (SS1) from two randomly selected school. The hypothesis was tested and the findings of the study shows; that students performed better in chemistry when taught using demonstration method as compared to the Project method group. That the male students are better in academic achievement when taught with demonstration method than when taught using Project method, that the female students achieve higher when taught with Project method than when taught with demonstration method. Price and Brooks (2012) in the findings of their study discovered that demonstrations improve students' performance on practice assignments, laboratory investigations and exams, as well as enhance student's understanding of concepts.

2.3.2 Project Strategy in Education

Udofia and Aniefiok (2013) carried out a research on Project and E-learning Teaching Methods and Students Skills Ac quisition in Electrical Installation Works in Technical Colleges in AkwaIbom State. They used non-randomized pretest post-test control design and outlined four (4) each of objectives, research questions and null hypotheses for the study. The 90 electrical electronics students in the two technical

colleges were used as population and sample for the study. Skill acquisition test (SAT) was developed by the researchers and used for data collection. Four objectives, four research questions and four null hypotheses were stated. Mean and analysis of covariance (ANCOVA) were used to analyse the data. Hypotheses were tested at significant level of 0.05. The researchers found that there was significant difference between students taught with project method and those taught using E-learning. Project method group performed better.

Adekoya and Olatoye (2010) in their study on the effect of project base and lecture method of teaching on student's achievement in agricultural science, found that project method of teaching brought more significant change in the academic achievement of students in agricultural science. Ameh & Dautani (2012) carried out experiment on the academic achievement of students in chemistry in Nassarawa local government Area of Kano State. The sample of the Study was fifty-eight (58) chemistry students in senior secondary one (SS1) from two randomly selected school. The hypothesis was tested and the findings of the study shows; that students performed better in chemistry when taught using demonstration method as compared to the Project method group. That the male students are better in academic achievement when taught with demonstration method than when taught using Project method, that the female students achieve higher when taught with Project method than when taught with demonstration method.

2.3.3 Influence of gender on Students' achievement in Chemistry

Maccoby&Jacklin, (1974); Eshiwani, (1984) show no significant sex difference in mathematical ability up to adolescence (13 – 14 yrs.), afterwards, males outperform females on nearly all tasks related to mathematical ability. This is attributed to differences in cultural pressures (Fennema& Sherman, 1978), whose one of its manifestations is math's anxiety, which leads to females' avoidance of mathematics

courses. Hence they avoid courses that entail the use of mathematics for example chemistry and physics.

Sex differences in attitudes, aspirations and other motivational orientations towards science are large in some subject areas than others. Females have more positive attitudinal orientation towards biological sciences while male towards the physical sciences (Comber and Keeves, 1973; Keeves &Kotte, 1991; Postelthwaite & Wiley, 1991; Kotte, 1992). Girls have a positive orientation towards biology because it requires less of Math's and spatial ability. Biology also deals with life's processes, which are related to maternal role, thus biological knowledge is often perceived by females as inevitable in the fulfillment of their motherhood duties. Biology also revolves around the verbal propensities of girls and thus serves as a vehicle for girls increasing interest. Males' positive orientation towards physical sciences has been attributed to the "out of school learning". Many activities in physical science can be learnt outside the classroom, and boys have more opportunities to develop positive attitudes in these areas (Kelly, 1981). Cognitive superiority in males (Maccoby and Jacklin, 1974) is frequently proposed as an explanation for boys more positive orientation towards physical science. It is primarily the acquisition of proficiency in a subject that leads to positive attitudes in that subject. Therefore, boys will hold a more positive attitude towards physical science. Low performance of girl s in physical science may be due to low attitudes.

2.4 **Summary of Literature Reviewed**

From the review of related literature, it is observed that the concept of Chemistry has been discussed in details showing various definitions and opinions of early Chemist. In the same vein these early Chemist made their own comments on what Chemistry as a study does and what it is. They equally made mention of how functional the study of Chemistry could make one be in the society. On the other hand, the review shows that

the definition of achievement and its meaning. It went further to exposed that whatever activity that takes place in school's educational achievement is the end point and outcome. Also academic achievement in the review was linked with intelligence of the learners expressing that those with higher IQ achieves more than those with lower IQ. Furthermore, the concept of achievement was brought to limelight as an outcome of activities engaged in. The review went ahead to x-ray the concept of motive which shows that when students learn with they tend to devote more attention to the material than when they learn by effort. In the same demonstration situational achievement can take place temporally due to sight, sound or words. Literatures also showed the practical that are popularly used in the study of Chemistry, It was observed that the Practical approach give Chemistry a concrete look in the teaching and learning and as such instructors make use of it very well mostly in quantitative topic. In that case, the review equally showed the important relationship between Practical in which chemistry models are built on. In the same vein the review showed that practical representation of concepts is a strategy respected in the teaching of chemistry. It is also show that instructional materials are important in the teaching of Chemistry is secondary school and made mention and discussed methods of teaching Chemistry. In continuation literature reviewed cognitive Load theory which states that our working memory is limited with respect to the amount of information it can hold, and the number of operations a learner should be encouraged to use efficiently, especially when learning a difficult task. Ausubel theory which suggested that meaningful learning comes when we relate new knowledge to relevant concepts already known to create an interaction with the learner's knowledge to make learning meaningful.

The related literature reviewed in relation to Practical and achievement in Chemistry showed that all the studies carried out reported that Practical brings about

positive achievement on the part of the student, using demonstration and Project teaching method. Also in all these studies reviewed, there were no studies that focused on interest in Chemistry in which the present study is interested in. In that case this study therefore Investigate the effect of demonstration and discussion method of teaching on students' interest in Chemistry. In addition, Demonstration and Project methods showed positive results in other subjects like Physics and Agricultural science.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter is discussed in line with the following sub-headings;

Research Design, Population of the Study, Sample and Sampling Techniques,

Instrument for Data Collection, Validation of Research Instrument, Reliability of Research Instrument, Method of data Collection and Method of Data Analysis.

3.2 Research Design

The design of this study is the quasi-experimental research design. To be specific, it is nonequivalent pretest-posttest control group design. This design was used because the researcher cannot randomly sample and assign subjects into groups under normal school situation. Thus he has to use groups already in existence such as groups already organized as intact class in order not to disturb the normal class and school settings. It is practical represented as follows;

Table 3.1: Research Design

Grouping	Pretest	Research condition	Post test
Demonstration	01	X_1	02
Project	01	X_2	02

Key: 01 = Pre-test, 02 = Post-test, X1 = Treatment, X2 = control

3.3 Population of the Study

The population of the study was 1,000 senior secondary school two (SSS2) Chemistry students in two public schools in Minna Municipal Niger state. The reason for the choice of choosing SSS2 students is because Saponification concept in chemistry is in the SS2 syllabus.

3.4 Sample and Sampling Techniques

The sample size for the study is 107 students in two (2) intact classes in the senior secondary school two (SSS2) class. The schools were randomly drawn from the two (two) schools using simple random sampling by balloting without replacement. Amongst the schools that were selected, one was assigned to the demonstration method group and the other was assigned to discussion method group using Simple random sampling by balloting without replacement. The two schools selected were considered to share in the same environmental conditions and routine.

3.5 Research Instrument

One instruments was used for data collection. This instruments is; the

Chemistry Achievement test (CAT). For the CAT, 20 questions were given to them on a question papers. The questions were based on the concepts that were used for the study Test items were chosen from Industrial Chemistry (Saponification). The Instrument has two section. Section A and B. Section A contain information on students demographic namely Name, school, age, sex, and occupation while section B has information on the content taught. The CAT has 20 questions with five option which only one question is correct. Therefore, the students are expected to tick the correct answer.

3.6 Validation of Research Instrument

20 question of CAT was given for validation, 2 lecturers in Science Education Department, Federal University of Technology Minna to find out if the test Items

measured what it was meant to measure considering also if the language of the test is simple and clear. Corrections made by experts were effected and ambiguous items were removed.

3.6.1 Reliability of the Research Instrument

The researcher carried out a trial testing of the Chemistry Achievement test to estimate the reliability of the instrument. The instrument was subjected to trial testing using fifty (50) SSS2 Chemistry students from Minna Municipal who were part of the population but not part of the sample selected for the study. The reasons for the trial testing were as follows:

1. To determine the reliability coefficient of CAT.
2. To find out if the time allotted for the test was enough.

The reliability coefficient of the study was 0.72 indicating that the instrument is reliable for the study.

3.7 Method of Data Collection

The researcher visited the research school two weeks before the beginning of the research and sought for official permission from the school authority to commence the research. Two research assistant were trained to assist the researcher in administering the achievement test. The study lasted for 4 weeks. The first week was used to administer the pre- test to test their entry behavior. The students were taught for 4 weeks after which they were administered the CAT to test their achievement level. The two Classes in each of the schools that were used for the study were randomly assigned to both experimental and control group. The first group was taught Saponification concepts with demonstration method of teaching and the second group was exposed to project method of teaching. Chemistry teachers of the schools sampled were used for carrying out the study. The lesson notes for both the demonstration method and project

method of teaching were used by the teachers for the study. The researcher together with the research assistant that were trained administered the test to the students. The time allotted for the test was Two hours. Each question carried 1mark making a total of twenty marks. The following steps were involved in administering the questionnaire.

The researcher with help of the subject teachers in schools administered the test to the Students; the time allotted for the test is 40 minute. The question papers were retrieved from the students after test. The teachers equally helped in marking and Scoring of the pre-test. Also with help of the subject teachers, the treatment was administered using all the concepts selected for the study. Two (2) lesson plans were prepared based on the topic and were used for the treatment. Two (2) lesson plans were used for the demonstration Method group, while the other five (5) were used for the project Method group. Both are same topics to know the difference and the effect. At the end of the treatment based on the two different teaching methods, the post-test was administered to the students with help of the subject teachers at the allotted time of two (2) hours. The answer scripts were collected, marked and scored with the help of the subject teachers

3.8 Method of data analysis

Mean and standard deviation (SD) were used in answering the research questions. While the research hypotheses were tested using the T-test analysis at 0.05 level of significance.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter is concerned with the presentation of results from data analysis.

The results are presented in tables according to the research questions and hypotheses that guided the study.

4.1 Presentation of Results

4.1.1 Pretest and Posttest Result of the Experimental and Control Group

The test is to determine experimental and the control groups equivalences to analyze the pretest and the posttest data mean and standard deviation of the two group using t-test.

4.2 Research Question Analysis

Research Question 1

What is the mean achievement scores of students exposed to demonstration and project teaching method in saponification concept in Chemistry?

Table 4.1: Pretest and Posttest Result of the Experimental and Control Group

Mean achievement scores of students exposed to demonstration and project teaching method in saponification concept in Chemistry?

Variable		**Pre-test**		**Post-test**		
Teaching Method	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean gain
Demonstration Method	44	20.92	7.25	68.18	12.67	47.26
Project Method	63	19.57	7.88	58.35	16.06	38.68

Results in Table 1 show that the group taught using demonstration method had a pre-test achievement mean of 20.92 with a standard deviation of 7.25 and a post-test achievement mean of 68.18 with a standard deviation of 12.67. The difference between the pre-test and post-test mean was 47.26. The group taught using project method of teaching had a pre-test achievement mean of 19.57 with a standard deviation of 7.88 and a post-test achievement mean of 58.25 with a standard deviation of 16.06. The difference between the pre-test and post-test mean was 38.68. However, for each of the groups, the post-test means were greater than the pre-test means with the group taught using demonstration method having a higher mean gain. This is an indication that demonstration method of teaching has more positive effect on students' achievement in *in* saponification concept in Chemistry than the project method.

Research Question 2

What is the influence of gender on the mean achievement scores of students exposed to demonstration teaching method in saponification concept in Chemistry?

Table 4.2: The mean scores and standard deviation of pretest, posttest for male and female students

Mean and Standard deviation of pre-test and post-test of the mean achievement scores of students exposed to demonstration teaching method.

Variable		**Pre-test**		**Post-test**		
Gender	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean gain
Male	20	20.30	8.19	73.15	10.93	52.85
Female	20	19.60	6.83	64.75	13.55	45.23

Results in Table 3 show that the male group taught using demonstration teaching method saponification concepts in Chemistry had a pretest achievement mean of 20.30 with a standard deviation of 8.19 and a post-test achievement mean of 73.15 with a standard deviation of 10.93. The difference between the pretest and post-test mean for the male group was 52.85. The female group had a pretest achievement mean of 19.60 with a standard deviation of 6.83 and a post-test achievement mean of 64.75 with a standard deviation of 13.55. The difference between the pretest and post-test mean for the female group was 45.23. However, for each of the groups, the post-test means were greater than the pretest means with the male group having a higher mean gain. This result shows that male students performed better achievement in chemistry than the female students in demonstration teaching method.

Research Question 3

What is the influence of gender on the mean achievement scores of students exposed to project teaching method?

Table 4.3: The mean scores and standard deviation of pretest, posttest for male and female students

Mean and Standard deviation of pre-test and post-test of the mean achievement scores of students exposed to project teaching method.

Variable		**Pre-test**		**Post-test**		
Gender	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean gain
Male	20	18.35	5.93	50.20	15.32	31.85
Female	20	22.55	6.67	60.10	19.78	37.55

Results in Table 3 show that the male group taught using project teaching method saponification concepts in Chemistry had a pretest achievement mean of 18.35 with a standard deviation of 5.93 and a post-test achievement mean of 50.20 with a standard deviation of 15.32. The difference between the pretest and post-test mean for the male group was 31.85. The female group had a pretest achievement mean of 22.55 with a standard deviation of 6.67 and a post-test achievement mean of 60.10 with a standard deviation of 19.78. The difference between the pretest and post-test mean for the female group was 37.55. However, for each of the groups, the post-test means were greater than the pretest means with the male group having a higher mean gain. This result shows that female students performed better achievement in chemistry than the male students in project teaching method.

4.3 Pretest and Posttest Result for Experimental and Control Group

4.4 Hypothesis 1

There is no significant difference in the mean achievement scores of the students exposed to demonstration and Project teaching method in saponification concept in Chemistry.

Table 4.4: T-test Analysis of scores for the demonstration and project teaching method

Analysis t-test of the mean achievement scores of the students exposed to demonstration and project method of teaching saponification concepts in Chemistry.

Variable	No	Mean ($\bar{X}$)	SD	Df	t-test	P-value	Remarks
Demonstration	44	68.18	12.67				
				105	3.42	0.001	Significant
Project	63	58.25	16.06				

Ns = Not significant at $p < 0.05$

Table shows that the students when taught using demonstration teaching method record a mean score of 68.18, standard deviation of 12.67, while the project group had a mean score of 58.25, standard deviation of 16.06, with both having degree of freedom (df) = 105 and t-cal at p = 0.001 which is less than 0.05, the null hypothesis was not accepted. This implies that there was significant difference in the mean achievement scores of the students exposed to demonstration and Project teaching method in saponification concept in Chemistry.

4.5 Hypothesis 2

There is no significant difference in the mean achievement scores of male and female students exposed to demonstration in saponification concept in Chemistry.

Table 4.5: T-test Analysis of scores for male and female in demonstration teaching method

Analysis t-test of the mean achievement scores of the male and female exposed to demonstration in saponification concept in Chemistry.

Variable	No	Mean ($\bar{X}$)	SD	Df	t-test	P-value	Remarks
Demonstration	20	73.15	10.93				
				38	2.16	0.037	Significant
Project	20	64.75	13.55				

Ns = Not significant at $p < 0.05$

Table shows that the male students when taught using demonstration teaching method record a mean score of 73.15, standard deviation of 10.93, while the female had a mean score of 64.75, standard deviation of 13.55, with both having degree of freedom (df) =

38 and t-cal at p = 0.037 which is less than 0.05, the null hypothesis was not accepted. This implies that there was significant difference in the mean achievement scores of male and female students exposed to demonstration in saponification concept in Chemistry.

4.6 Hypothesis 3

There is no significant difference in the mean achievement score of male and female students exposed to Project teaching method in saponification concept in Chemistry.

Table 4.6 t-test Analysis of scores for male and female in project teaching method

Analysis t-test of the mean achievement scores of the male and female exposed to project in saponification concept in Chemistry.

Variable	No	Mean ($\bar{X}$)	SD	Df	t-test	P-value	Remarks
Male	20	50.20	15.32				
				38	-1.77	0.085	Not significant
Female	20	60.10	19.78				

Ns = Not significant at p < 0.05

Table shows that the male students when taught using project teaching method record a mean score of 50.20, standard deviation of 15.32, while the female had a mean score of 60.10, standard deviation of 19.78, with both having degree of freedom (df) = 38 and t-cal at p = 0.085 which is less than 0.05, the null hypothesis was not accepted. This implies that there was significant difference in the mean achievement scores of male and female students exposed to project in saponification concept in Chemistry.

4.7 Summary of the Findings

This section of the chapter is a summary of the findings of the study according to each of the tested hypotheses. From the data analysis and interpretation of the results, the following findings emerged;

1. Male and female students differ in their mean achievement scores when taught Saponification concepts in Chemistry using demonstration and project method.
2. Demonstration method of teaching had more positive effect on students' achievement in Saponification concepts in Chemistry than the Project method.

CHAPTER FIVE

5.0 SUMMARY, RECOMMENDATION AND CONCLUSION

In this chapter, the researcher presents the discussion of the results of the study, implications of the study, recommendations, limitations of the study, suggestion for further study and conclusion.

5.1 Summary of the Study

The main purpose of the study was to determine the effects of demonstration and project method of teaching on students' achievement in some concepts in Chemistry. The problem that necessitated the study was students' low achievement in Chemistry as reported by research. To contribute to the existing body of knowledge on this issue, the researcher studied the effectiveness of the use of these two methods in teaching Chemistry. The review of literature was carried out under three broad headings namely conceptual framework, theoretical framework and empirical studies. The study adopted quasi-experimental design - a non-equivalent pretest-posttest control group design. The population of the study comprised of all SS2 students from Minna Municipal. The researcher used two intact classes out of which one was taught using demonstration teaching method while the other class was taught using project method. An instruments was used for data collection was; Chemistry Achievement Test (CAT) developed by the researcher. The reliability of these instruments was established as 0.12 Mean and standard deviation were used to provide answers for the research questions while t-test analysis was used to test the hypotheses at 0.05 level of significance.

The result of the study, among others showed that demonstration teaching method increases students' achievement in Chemistry more than project method. Based on the findings of this study, the researcher, among others recommended that Chemistry

teachers should endeavor to develop and use demonstration method as it would enhance overall achievement in Chemistry as well as help reduce gender gap in the subject.

The finding of the study as presented in table 2 showed that demonstration method of teaching has more effect on students' achievement in Chemistry than the project method. The two methods proved to have the same effects on both the male and female students when taught saponification concepts in Chemistry.

5.2 Recommendations

The following recommendations have been made based on the findings of this study.

1. Chemistry teachers should endeavor to develop and adopt the use of demonstration method as it would enhance overall achievement in Chemistry as well as help reduce gender gap in the subject.
2. Regular sensitization workshops should be organized to retrain Chemistry teachers on the development and use of both project and demonstration teaching methods.
3. The use of project and demonstration teaching methods should be encouraged during pre-service teacher training programs.
4. Government, in conjunction with other professional bodies, should sponsor further research on the use of project and demonstration teaching methods.

5.3 Limitations of the study

The conclusions made with respect to this study are however subject to the following limitations.

1. Some students dropped out of the study before the end of the experiment. Some completed the pretest only while others posttest only. These categories of students were dropped thereby reducing the sample size.

2. The researcher used only two intact classes in the entire population and this may affect the generalization of this study to other areas.

5.4 Suggestions for Further Study

1. An investigation into the effect of teaching methods using different subject in different geographical spread.
2. A replication of the study using other states of the federation
3. A replication of the study to cover the entire South Eastern region of Nigeria.

5.5 Conclusion

The following conclusions are drawn from the findings of the study.

Project method of teaching proves to have more effect on students' achievement in Chemistry than the demonstration method.

1. There was significant difference in the mean achievement scores of the students exposed to demonstration and Project teaching method in saponification concept in Chemistry.
2. There was significant difference in the mean achievement scores of male and female students exposed to demonstration in saponification concept in Chemistry.
3. There was significant difference in the mean achievement score of male and female students exposed to Project teaching method in saponification concept in Chemistry.

The findings of this study have provided empirical evidence for the use of good teaching methods in teaching Chemistry. It has some implications for teachers and students and policy makers. One obvious implication is that Chemistry teachers could promote interest and achievement in Chemistry by developing and sustaining students' achievement in the subject through the use of project method of teaching. The teaching

method has different approaches embedded in it that will encourage students of different background and gender to Chemistry effectively. Furthermore, teaching students using demonstration method would assist the teacher in providing learning environment that is conducive for the teaching and learning of Chemistry. Both demonstration and project teaching methods were effective in reducing gender gap in students' achievement in Chemistry and this implies that the regular use of the methods by Chemistry teachers could greatly enhance the achievement of male and female students in Chemistry.

References

Adekoya, Y.M. and Olatoye, R.A. (2010). Effect of project-based demonstration and lecture teaching strategies on senior secondary students' achievement in an aspect of Agriculture. *International journal of educational research and Technology*, 1(1), 19- 29. http://www.soeagra.com. Retrieved 18th August, 2014.

Agharuwhe, A.A &Ugbrugbo, N. (2010). Teachers' effectiveness and students' academic Performance" *Study Home Communication Science. 3(2),* 107-113. Retrieved 20th November 2010 fromhttp://www.google.gwe.edu

Akinbobola AO, Ikitde GA 2011. Strategies for teaching mineral resources to Nigeria secondary school science students. *African Journal of Social Research and Development*, 3(2): 130-138.

Akpan, E.U.U (20 I0) government and science and technology education in Nigeria, Journal of educational issues. 1(1), 101-113.

Akunya L. I. (2006). *The methodology of Economics*, Webs media Communication, Owerri.

Ali, A. (1998). *Strategic Issues and Trend in science Education in Africa*. Onitsha: Cape Publishers International Limited.

Ameh, P. O. and Dantani Y. S (2012) Effect of Lecture and Demonstration Methods On the Academic Achievement of Students in Chemistry in Nassarawa Local Government Area of Kano Sciences, *International Journal of Modern Social Sciences* 2012, 1(1), 29-37.

Anyanwu, J. P. (1987). The problem Adler, M. (1985). *How to speak, how to listen.* New York: Collier Books.

Ausubel, D. P (1960). *The use of advanced organizers in the learning and retention of meaningful verbal materials. Journal of Educational Pschology*, 51,267 – 272.

Auwal, A. (2013). Effects of teaching methods on retention of agricultural science knowledge in senior secondary schools of Bauchi local government area, Nigeria. *International Journal of Science and Technology Education Research,* 4(4) 63-69

Bakke M, M. (2004). *Effect of Guided Inquiry Teaching on Students' Achievement in Logic*, Unpublished M.Ed. Thesis, Faculty of Education University of Nigeria, Nsukka.

Berline. D. (1984). "The Half-full Glass: A Review of Research on Teaching", in P. Hosferd (ed). Using what we know about Teaching. Alexandra, Va: Association for Supervision and Curriculum Development.

Cabibihan JJ 2013. Effectiveness of student engagement pedagogies in a mechatronics module: A 4-year multi-cohort study. *Journal of the NUS Teaching Academy*, 3(4): 125-149.

Carrier K 2005. Key issues for teaching learners in the classrooms. *Middle School Journal*, 37(4): 17-24.

Chamberlain, V.M. and Kelly K.M. (1981). *Creative Home Instruction*. USA: Mac Graw Hill lank.

Chingombe S. I. (2013). Impacts of the Demonstration Method in the Teaching and Learning of Hearing Impaired Children. *Journal of Humanities and Social Science,* 12 (1), 48-54. www.Iosrjournals.Org. Retrieved 18th August, 2014.Fagen J, Callan P, Mazur E 2004. Classroom demonstrations: Learning tools or entertainment? *American Journal of Physics*, 72(6):838.

Daluba, N. E. (2013). Effect of demonstration method of teaching on students' achievement in agricultural science. *World Journal of Education*, 3(6). Retrieved from http://www.sciedu.ca/wje *discussion: A multidisciplinary study* (pp. 163–191). Norwood, NJ: Ablex.

Duruji, M., Azuh, D., Sedun, J., Olarenwaju, I. P. & Okorie, U. (2014). *Teaching methods and assimilation of students in tertiary institutions: A study of Covenant University, Nigeria*. Proceedings of EDULEARN 14 Conference, 7th-9th July; Barcelona, Spain, Pp. 5116-5126

Edmond, A. O. & Ayodele, O. (2014). Effect of project instructional approach on the achievement of building construction students in technical colleges in Ogun State, Nigeria. *Global Journal for Research Analysis,* 3(5) 35-38

Edu, D. O., Ayang, E. & Idaka, I. (2012). Evaluation of instructional methods and aptitude effectson the psychomotor performance in basic electricity among technical students in southern Educational zone, Cross Rivers State, Nigeria. *American International Journal of Contemporary Research*, 2(2) 117-123

Eilks, I., Prins, G. T., & Lazarowitz, R. (2013). How to organize the classroom in student – active mode. In I. Eikles & Hofstein (eds.). Teaching chemistry – A study book (pp. 183-212). Rotterdam: Sense.

Felder RM, Woods DR, Stice JE, Rugarcia A 2000. The future of engineering education II. Teaching methods that work. *ChemEngr Education,* 34(1): 26–39.

Ganyaupfu, M. E. (2013). Teaching methods ad students' academic performance. South Africa: *International Journal of Humanities and Social Science Invention,* 2(9) 29-35. Retrieved from http://www.ijhssi.org

Gbamanja, S.P.T. (1991). *Modern methods in Science Education in Africa*. Port Good, T.I. and Brophy, J.E. (1991). Looking in Classrooms. New York: Harper Collins. Government Area of Kano Sciences, *International Journal of Modern Social* Graw Hill lank. Harcourt: Totan publishers. http://www.uv.es/revispsi/articulos1.01/dasi.pdf. Retrieved 18th August, 2014.

Idoko, C. U. (2014). Skill acquisition and youth employment in Nigeria. *Global Journal of Commerce and Management Perspective* 3(1) 51-54

Kara, O., Bagheri, F., &Tolin, T., (2009). Factors Affecting Students' Grades in Principles of Economics. *American Journal of Business Education 2*(7), 25-37.

Kasulis, T. (1986). Questioning. In M. M. Gilette (Ed.), *the art and craft of teaching.*

Kuntzleman, T. S., Rohrer, K., & Schultz, E. (2012). The chemistry of light sticks: Demonstrations to illustrate chemical processes. *Journal of Chemical Education, 89*, 910-916.

Maduabum, M.A. (1989). *Teaching Integrated Science Effectively*, Space Matrix publications Limited, Onitsha: Nigeria.

McCabe Jennifer A 2014. *Learning and Memory Strategy Demonstrations for the Psychology Classroom.* Baltimore: Goucher College.

Meherens W. A. &Lehman I.J (1978). *Measurement and Evaluation in Education and Psychology* (2nd Ed) New York: Holt, Rinehart and Winston inc.

Modebelu, M. N., & Nwakpadolu, G. M. (2013). Effective teaching and learning of agricultural science for food security and national sustainability. *Journal of Education and Social Research,* 3(4), Pp. 161-170.New York: McGraw-Hill, Inc.

Newmann, F. (1990). Higher order thinking in teaching social studies: A rationale for the of classroom thoughtfulness. *Journal of Curriculum Studies, 22*, 41–56.

Niemi, D. (1999). Assessment models for aligning standards and classroom practice. UCLA Graduate School of Education and Information Studies. Center for the Study of Evaluation. *National Center for Research on Evaluation, Standards And Student Testing. Conference of the American Association of School Administrators.* http://www.uv.es/revispsi/articulos1.01/dasi.pdf

Odom, A. L., & Bell, C. V. (2015). Association of middle school student science achievement and attitudes about science with student-reported frequency of teacher lecture demonstrations and students –centered learning. *International Journal of Environmental & Science Education, 10* (1) 87-97.

Ogologo, G. A. & Wagbara, S. (2013). Effect of demonstration strategy on senior secondary school students' achievement in separation techniques in chemistry in Obio/Akpor local government area, Rivers State. *Journal of Vocational Education and Technology,* 10(1 &2),Pp. 15-29.

Ogwo BA, Oranu RN 2006. *Methodology in Formal and Non-Formal Technical/Vocational Education*. Enugu: Ijejas Printers and Publisher.

Okeke, 0.1 (20 II) Effect of Mend Mapping Teaching Strategy on students Interest, Achievement and Retention in Senior Secondary School Chemistry. Unpublished Ph.D. Thesis. University of Nigeria, Nsukka.

Olatoye, R. A. & Adekoya, Y. M. (2011). Effect of project-based, demonstration and lecture teaching strategies on senior secondary students, achievement in an aspect of agricultural science. India: *International Journal of Educational Research and Technology,* 1(1), Pp. 20-25

Onah J. N. (2008*), Effect of Concept Mapping and guided inquiry teaching methods on students' achievement in biology*. Unpublished Master's Degree Thesis University of Nigeria, Nsukka.

Price, D. S., & Brooks, D. W. (2012). Extensiveness and perceptions of lecture demonstrations in the high school chemistry classroom. *Chemical Education Research and Practice, 13*, 420-427.

Prpic JK, Hadgraft RG 2009. What is Problem-Based Learning? From<http://www.dlsbweb.rmit.edu.au/eng/ beng0001/learning/strategy> (Retrieved on 3 December 2009).

Sadker, M.P. and Sadker D.N. (1991), Teachers, Schools and Society. Schooling in social context. Cambridge, England: Cambridge University Press.

Sweeder, R. D., & Jeffery, K. A. (2013). A comprehensive general chemistry demonstration. *Journal of Chemical Education, 90*, 96-98.

Tharp, R. G., &Gallimore, R. (1988). Rousing minds to life: Teaching, learning, and UCLA Graduate School of Education and Information Studies. Center for the

Udofia, N. &Aniefiok, E. U. (2013). Project and e-learning teaching methods and students skills acquisition in electrical installation works in technical colleges in AkwaIbom State. *Academic Journal of Interdisciplinary Studies,* 2(2). Rome: MCSER-CEMAS; Sapienza University.

APPENDIX A

Federal university of Technology

School of Science and Technology

Education

Department of Science Education.

P.M.B 65, Minna Niger State.

26th October 2019.

Dear Respondents.

RESEARCH CHEMISTRY ACHIEVMENT TEST

I am a final year student of the above name institution and as a requirement for the award of B.TECH. ED. I am carrying out research on the topic: Effect of demonstration and project teaching method in senior secondary school chemistry student's achievement in Minna Municipal. I will be very grateful if you could facilitate my endeavor by given the student to answer the question. I assure you that all the information in the questions will be treated with confidence. Thanks in Anticipation.

Yours Faithfully

Kareem Omuya Samuel

Section A

Name: _____

Name of School: _____

Age: _____

Sex: _____

Occupation: _____

APPENDIX B

Section B

Tick the correct answers to the following questions.

1 The saponification of an alkanoate to produce soap and alkanol involves (A) dehydration (B) esterification (C) hydrolysis (D) oxidation

2 Which of the following substances are all made by the process of polymerization?(A) Nylon and soap (B) Ethanoic acid margarine and ethanol (C) Nylon and artificial rubber (D) Soap and butane (E) Margarine and nylon

3 What is the byproduct of a soap molecule? (A) glycerol (B) hydrophilic (C) hydrophobic (D) Phenol

4 Saponification is used to make _____? (A) Lotion (B) Perfume (C) Soap (D) Juice

5 Which of the following is needed in saponification? (A) Strong acid (B) Strong base (C) Weak base (D) Weak acid

6 Why is Lye used for saponification to take place? (A) It is a strong base. (B) It is a strong acid. (C) It is part of the glyceride within the structure. (D) It makes the rate of saponification increase.

7 What are the two reactants needed for saponification? (A) Acid and a base (B) Alcohol and an acid (C) Ester and ether (D) Fat and a strong base

8 Along with soap, what is a product of saponification? (A) Oxalic acid (B) Acetic acid (C) Glycerol (D) Methene

9 The hydrolysis of a fatty base is_____? (A) Esterfication (B) Saponification (C) Neutralization (B) Titration

10 Lye is a concentrated solution of which ionic compound? (A) K_2CO_3 (B) $CuSO_4$ (C) NaOH (D) NaCl

11 Which of the following term describe saponification? (a) Cleaving of ester molecules into carboxylic acid and alcohol (b) Dehydration synthesis by removing water (c) Hydrolysis of a salt by adding a weak acid (d) Synthesis of two alkyl groups to make an ether

12 Ethanol reacts with concentrated tetraoxosulphate (V) acid at a temperature above 170^{o}C to form (A) ethanone (B) ethane (C) ethyne (D) ethanol

13 Which of the following processes can saponification be used for? (A) For the production of plastics (B) To make soap (C) In blow glass artistry (D) The formation of alloys

14 Soap can be precipitated out by salting using which chemical compound? (A) Sodium chloride (B) Potassium hydroxide (C) Glycerol (D) Sodium hydroxide

15 Saponification value is the number of milligrams of KOH required to saponify what present in the 1g of oil or fat? (A) Salts (B) Hydrocarbon (C) Fatty acids (D) Unsaturation

16 Which of the following compound is an industrial manufacturing product by saponification?(A) Sodium chloride (B) Potassium hydroxide (C) Glycerol (D) Sodium hydroxide

17 A colorless hydrocarbon with a sweet smell undergoes substitution reaction. The hydrocarbon is likely to be (A) alkanol (B) benzene (C) ester (D) methane

18 The major product in the solvay process is _____? (A) NaOH (B) Na $2CO_3$ (C) NH_3 (D) H $_2SO_4$

19 Which of the following fat or oil is unsaponifiable? (A) Paraffin wax (B) Bee wax (C) Olive oil (D) Shea butter

20 2 - methyl propan -2- ol is an example of a (A) primary alkanol (B) secondary alkanol (C) tertiary alkanol (D) quartenary alkanol

ANSWERS

1. C

2. C

3. A

4. C

5. B

6. A

7. D

8. C

9. B

10. C

11. C

12. B

13. B

14. D

15. C

16. D

17. C

18. B

19. A

20. C