AN INVESTIGATION INTO THE TEACHING OF ELECTROLYSIS IN SCHOOL CERTIFICATE CHEMISTRY IN ISEYIN LOCAL GOVERNMENT, OYO STATE, NIGERIA

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CERTIFICATION

This is to certify that this study was carried out by FASASI, Muhammed Mosadoluwa (17/25PB055) and has been read and approved as meeting part of the requirements of the Department of Science Education, Faculty of Education, University of Ilorin, Ilorin, Nigeria for the award of Bachelor of Science Education [B.Sc.(Ed)] degree.

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ABSTRACT

One of the foundational topics in senior secondary school chemistry is electrolysis. It is one of the topics that contribute to students' success in their senior secondary school certificate examination. Its teaching and knowledge acquisition should be excellent to achieve good performance from learners. Hence, this research study sought to investigate how Electrolysis is being taught in the Iseyin Local Government Area, Iseyin. Oyo State, Nigeria.

The study was a descriptive research type, and a validated questionnaire was used to obtain data. The questionnaire named "Questionnaire on the teaching of electrolysis in Iseyin local government area of Oyo state" was taken to schools in the said area with a consent form from the Department of Education. After the administration and collation of questionnaires from respondents, the data was subjected to analysis using SPSS 23 to analyse the data.

The study revealed that the teaching of Electrolysis in Iseyin is only fair. Out of all the 4 sections of the questionnaire, only about half of the respondents met the requirement for teaching Electrolysis in senior secondary school. This implies that if there are insufficient teachers meeting the requirements for teaching Electrolysis in Iseyin, there will be poor performance.

The study therefore recommended, among others, that for the teaching of electrolysis to be successful in Iseyin, both the human and non-human resources must be put in check. For the human resources, academic qualifications and years of teaching experience are key factors. For the non-human resources: instructional methods and materials, practical experiments, and availability of textbooks must be put in check for successful teaching of Electrolysis.

CHAPTER ONE

INTRODUCTION

Background to the Problem

Science is an organized body of knowledge that uses systematic approaches in exploring nature in a testable and verifiable manner in order to establish presumed relations among phenomena with the basic aim of improving the understanding of nature. Science is one of the core components of the school curriculum, so much so that it has a department of its own. It encompasses the teaching of subjects like Physics, Biology and Chemistry at the secondary school level. These are referred to as natural sciences.

Science teaching at various levels still retains the old conservative approach, with the teacher, in most cases, acting as the repository of knowledge and the students as the passive recipients. (Aladejana, 2007). The teaching of Chemistry at the secondary level in many countries is facing a lot of challenges. Upahi (2012) reported that, as a result of the difficult and complex nature of chemistry, it is one of the most conceptually difficult subjects on the school curriculum. It is of major importance that anyone teaching chemistry is aware of the areas of difficulty in the subject. Likewise, Online Etymology Dictionary revealed that to teach actually means to show, to demonstrate, give instruction or direct. Morrison (1934) defined teaching as an intimate contact between a more mature personality and a less mature one, which is designed to further the education of the latter, which could be manifested in the classroom setting in which the teacher is the more mature personality and the student is seen as the less mature one who seeks to further be enlightened. Caena (2011) sees teaching as a highly complex activity. No doubt it is because it surrounds every form of living, from the lowest level of reasoning to the highest level and ultimately till death.

Chemistry is the study of the composition of particles. Through the study of chemistry, we understand the composition of matter and, by extension, the composition of matter around us. In addition to the knowledge of matter composition, formation, the changes they undergo and what becomes of them in the very end, it is believed that Chemistry is a world filled with interesting phenomena, appealing experimental activities, and fruitful knowledge for understanding the natural and manufactured world. However the complexity of a phenomenon, it is very important that the study that opens our eyes to see and understand our environment to its core is taught with all simplicity and clarity. According to Chiu (2005) and Johnstone (2006), chemistry is a difficult subject for students to learn. The difficulties may lie in the capabilities of human learning as well as in the fundamental nature of the subject. This set the question of investigation into how Chemistry is being taught.

Electrochemistry is regarded as one of the most difficult chemistry concepts in which both pre-service teachers and students have learning difficulties (Nakhleh, 1992; Ogude, 1994; Ozkaya, 2002). Difficulties in electrochemistry have been traced to the inadequate understanding of the conceptual terms of the topic. It is noteworthy that these concepts range from concrete to abstract. Many students of chemistry find certain concepts difficult to comprehend. The root of many of these difficulties that students have in learning chemistry is traceable to inadequate understanding of the underlying concepts of the atomic model, and how these are used to explain macroscopic properties and laws of chemistry (Ben-Zvi, Eylon & Silberstein, 1988).

In Nigeria, different authors, Opara (2009), Ajeyalemi (2011) and WAEC (2011; 2012; 2013) have attributed learning difficulties to the abstract nature of many Chemistry concepts, didactic methods of instruction, students' levels of conceptual understanding, mathematical abilities, and problem-solving skills, among other factors that may be responsible for this poor

performance. For example, the performance of Chemistry students in 2006 – 2014 dropped to less than 50% as expected in 2010, 2013 and 2014. This implies that there is a difficulty somewhere that needs to be addressed. WAEC Chief Examiner attributed Poor performance to low level of communication skills, inadequate practical exposure, poor quantitative skills, inability to relate concepts in Chemistry to everyday life and lack of understanding of some Chemistry concepts (WAEC, 2006 - 2012). With the findings about why there is a decline in the success of Electrolysis in Secondary School Certificate Chemistry, and many proposed ways out, not much headway has been made.

Iseyin Local Government has about 30 Secondary Schools that teach Chemistry and Electrolysis as a topic in Chemistry. This number of schools have schools that operate on the Co-educational system and the gender-isolated educational system. Some of these schools are day schools, and others have boarding housing systems. Quite a number are privately owned, and a few are government establishments. In Iseyin Local Government, the number of schools that function on the co-educational system is more than those that function on the gender-isolated system. Possible challenges of the teaching of Electrolysis in all of these schools in Iseyin local Government, Oyo state, in the study is geared at ascertaining the exact challenges and providing a lasting solution. To this end, this research work seeks to carry out an investigation into the teaching of electrolysis in school certificate chemistry in Iseyin local government, Oyo state, Nigeria

Statement of the Problem

Students in the science department in Iseyin Local Government, Oyo state, all take Chemistry as a lesson. Naturally, experimenting practically stimulates the students and raises their eagerness to learn. It's been observed, however, that their zeal does not add up to their

performances in both continuous assessments and examinations. This leaves many questions unanswered. Could it be a pedagogical issue? It is believed that teachers should have a great knowledge bank as regarding the subject taught so they can appropriately be the facilitator of the classroom learning process. Perhaps it is a challenge of inadequate laboratory apparatus or an underdeveloped laboratory. Or could it be a teaching method and the use of instructional materials? All these aforementioned puzzles are the driving force of this study. It is to see that adequate answers are supplied and that the problem of woeful performance in electrolysis (practical and theoretical alike) is improved upon.

Electrochemistry is a topic in the curriculum of the Nigerian secondary school chemistry curriculum. According to Silberberg (2000), electrochemistry is the study of the relationship between chemical change and electrical work. It is a reaction that involves the transfer of electrons from one system to another outside the chemical system. Under the study of Electrochemistry, there are two main branches: (a) Electrolysis, (b) Electrochemical cells. The focus of this study is going to be based on Electrolysis. According to Wikipedia, the word electrolysis, using the Greek words e:lektron, meaning amber, and lysis, meaning dissolution, can therefore be defined as the chemical decomposition of a compound brought about by the passage of a direct current through an electrolyte

Muzammila, Johari and Murad (2013) revealed from several studies in the chemistry education literature that dealt with the learning difficulties of basic concepts of chemistry at schools, cautioned that if the basics of any topic are misunderstood or not understood, the deeper students get into it, the darker and more confusing the study becomes, resulting in poor performances. Garnett and Treagust (1992) investigated the understanding of conceptual knowledge in secondary school electrochemistry, while Sanger and Greenbowe (1997) carried

out their research among college students. The result obtained was that the majority of them lacked the understanding of the basic concepts of Electrochemistry. The study established that the understanding of basic concepts helps learners understand the topic both meaningfully and concretely.

Purpose of the Study

The purpose of this study is to investigate the teaching of Electrolysis in School Certificate Chemistry in Iseyin Local Government, Oyo State.

Specifically, the study seeks to determine:

1. the influence of instructional materials on senior school students when taught Electrolysis in chemistry
2. practical experiments that teachers conduct with senior school students on Electrolysis in chemistry
3. influence of school type on senior school students' achievement in Electrolysis in chemistry, and
4. Influence of gender on teaching of Electrolysis among senior school students in chemistry/?

Research Questions

The following research questions are raised and answered to guide the study

1. What are the qualifications of the teachers teaching chemistry in Iseyin Local Government Area?
2. How experienced are the teachers teaching chemistry in Iseyin Local Government Area?
3. Which teaching methods do teachers engage in teaching Electrolysis in Iseyin Local Government Area?

4. Are the required instructional materials for the teaching of Electrolysis in Iseyin Local Government Area available?
5. Are the instructional materials for teaching Electrolysis in Iseyin Local Government adequately available?
6. Are the practical experiments required in Electrolysis performed in secondary schools in Iseyin Local Government? and,
7. Do students have access to relevant Chemistry textbooks that treat the topic of electrolysis?

Scope of the Study

The study was carried out among chemistry students in senior secondary school (SSS) in some public and private secondary schools in Iseyin Local Government, Oyo State, Nigeria. As the subject of this research implies, the focus of the scope was on the teaching of Electrolysis.

It has been observed over the years that in Iseyin local government senior secondary schools, there are a few qualified science teachers, especially in Chemistry. The situation is such that we find out that a chemistry teacher shuffles lesson periods between a number of schools. A single teacher can be found teaching 4 schools at a time, and he or she has to go to these schools every day to hold his or her classes. This points to one of the reasons for this study. Could this be a cause to the poor performance of Electrolysis in Iseyin local government?

A teacher involved in this kind of enterprise cannot be effective for teaching, nor will he/she be effective for the students. What happens after a just-concluded class, and a student needs further explanation from the teacher? Such a teacher would not be available to illuminate the student. A little misconception today that is not addressed would ultimately affect the

performance of the students. Students vary; they require different attention. If a teacher is not readily available, a vacuum is created in the learning process of a student.

Another worthy note is the fact that not all available teachers are qualified to teach chemistry. We find out that graduates of courses such as Biochemistry, Industrial Chemistry, and a few other courses, who at one point or another, underwent chemistry courses in the university due to a lack of a job in the bigger world, resort to becoming Chemistry teachers in secondary schools. No postgraduate studies in Education, no professional training and certification, nothing. They just apply, and since there are no better alternatives, the schools employ them. This would undoubtedly affect the learning process of the students.

To this end, this study began, seeking to ascertain the root of the challenges, beyond speculations and to proffer substantial solutions.

Significance of the Study

The results of this study would be of immense benefit to:

The students where chemistry has become just an abstract learning. Students would find great assistance in acquiring a meaningful understanding of abstract chemical processes in the study of Electrolysis and performing experiments, as this would improve performance in examinations (internal and external).

More so, this study would aid the understanding of the gender factor in learning. Largely, the boy child is not shown as much love as the girl child, and although subtle, it contributes to the learning pace of the male student. The girl child who is shown adequate love both from parents and her teachers is more likely to be balanced and settled to learn than a boy child who receives

less. After the home, students spend more time in the hands of their teachers, and this calls for adequate investigation into how these teachers handle and teach them.

Likewise, it would be of benefit to the chemistry teachers. The findings of this study would help the teachers see how best to make use of instructional materials and inculcate teaching methods to help make their teaching comprehensible. It would also help teachers in understanding their environment of teaching and give them a head start in making the best of every potential they come across in the classroom. The results of this finding would enlarge the scope of their teaching profession to see more ways they can pass knowledge better.

Furthermore, school teachers from the findings of this study would contribute to knowledge about teaching and learning strategies in the classroom and laboratory environment to address teaching difficulties in abstract and difficult concepts of Electrolysis. The findings of the study would inform curriculum developers, science educators and chemistry teachers to devise relatable and Nigerian-based instructional guides to advance the teaching of Electrolysis.

Operational Definition of Terms and Variables

Senior Secondary School Certificate: This is the final examination written by students in Nigerian secondary schools at the end of their six years of education in secondary school.

Chemistry: This curriculum represents the minimum content to be taught in the Senior Secondary Programme.

Iseyin: is a city located in Oyo state, Nigeria. This research study is carried out in this city. It has an estimated population of 302,990 as of 2011, with about 250 Secondary Schools.

Teaching Method: the act of passing knowledge from a teacher to a learner(s)

Teachers' Qualification: refers to academic and professional qualifications that enable a person to become a registered teacher at all levels of education.

Teachers' Years of Experience: Teaching experience means the total number of years of teaching both in and outside the District of regular elementary education teachers. **Instructional Method:** is a teaching method that comprises the principles and methods used by teachers to enable student learning.

Practical Experiment: are hands-on workshops that students are engaged in to develop their specific skills to carry out scientific experiments.

Required Textbooks: are prescribed textbooks that are essential for the effective teaching of a subject.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The reviews of related literature were carried out under the following sub-headings:

1. Theoretical Framework of the Study
2. Studies on teachers' qualifications in teaching Chemistry
3. Studies on the teachers' experience of teaching Chemistry
4. Studies on the Teaching Methods in Chemistry
5. Studies on the availability and adequacy of Instructional Materials in the Teaching of Chemistry
6. Studies on the Influence of Practical Experiments on Students' Achievement in Chemistry
7. Studies on the availability of relevant chemistry textbooks in Teaching Chemistry
8. Appraisal of the Study

Theoretical Framework

The Theory of Constructivism

The origin of Constructivism is linked to Jean Piaget's theory of Cognitive Development. Bodner (1986) opined that constructivism is the science of constructed knowledge in the mind of a learner. That is, a learner carefully builds up knowledge in his or her mind and does not just passively take everything in. This is carried out based on experience (i.e., prior knowledge) and the individual's outlook on the world and a subject or topic of consideration, thereby integrating it with what is being taught. Among others who are protagonists of this learning theory are John Dewey, Lev Vygotsky, and Jerome Bruner. According to this learning theory, it is important to figure out what each student already knows about a topic before new knowledge is built. Learners have preconceptions, conceptions and misconceptions. When a student has so many

misconceptions without appropriate guidance and correction, such a student will ultimately perform poorly in any topic they undertake. Jean Piaget identified two major arms in this learning theory called assimilation and accommodation.

Assimilation simply means that new information is taken in without a change in the existing knowledge of the subject. This may be because the new information aligns with the existing knowledge or because the learner decides not to change a faulty understanding.

Accommodation, on the other hand, is the ability of a learner to accept new information or knowledge even though it doesn't align with what he or she has always known. For example, a student who has always thought the cathode pole is negative but is now taught it indeed is positive. The student would have accommodated the new knowledge by forgoing the prior knowledge for the new, accurate one.

Among other postulations under constructivism, another aspect to consider is the theory which says Naive theories affect learning. Resnick (1982) added that the learner has preconceptions and misconceptions, which may interfere with the ability to learn new material. These conceptions indeed affect how the learner learns, and hence, a system of finding them out must be employed. For instance, electrolysis has a practical aspect. Lawson (1995) suggested that moving the laboratory to the beginning may create interest in the material to be learned and give the teacher a chance to diagnose misconceptions the student may have. Gunstone (1994) also added that having students make predictions creates interest in the outcome. Also, it's advisable to have students explain the basis for their predictions using their present ideas. Of course, this makes them feel a tad ashamed if they're wrong, but a teacher must know how to control and create a suitable learning environment for the emotional state of the learners.

We are all a function of what we know. What we once knew, what we now know and what we will still know. Learning, as it's said, is a lifelong process, and we will always have to learn, unlearn and relearn.

Studies on Teachers' Qualifications on the Teaching of Chemistry in the School Chemistry Certificate

Chemistry is a practical-based course that needs appropriate qualifications and expertise to teach. Teachers must have these basic requirements for teaching to enable effective learning in the face of the growing challenges of societal and educational demands. Cecil H. Allen (2011) defined teacher education as the policies and procedures designed to equip prospective teachers with the knowledge, attitudes, behaviours, and skills they require to perform their tasks effectively in the classroom. Etiubon and Benson (2014) added that the Federal Government of Nigeria (FRN, 2004) clearly outlined the objectives of teacher training to include: producing highly motivated, conscientious and efficient classroom teachers for all levels of its educational system; to encourage further, the spirit of enquiry and creativity in teachers; to help teachers fit into social life of the community and the society at large; to enhance teachers commitment to national goals by providing them with the intellectual and professional background adequate for their assignment to help them adapt to changing situations, and to enhance their commitment to the teaching profession.

To this end, teachers' qualifications are an undisputed prerequisite for the teaching of any subject at all, in this respect, Chemistry. When we stress teachers' qualifications, we refer to the professional qualifications and the acquisition of relevant knowledge, skills, competence and creativity needed for productive teaching. The quality of education is directly related to the quality of instruction in the classroom. It is a fact that academic qualification, knowledge of the

subject matter, competence, skills of teaching and the commitment of the teachers have effective impacts on the teaching and learning process (National Policy of Education 2010). Dovrat Committee (2005) observed that teachers' certification status and degree in the area of specialisation are very significant and positively correlated with students' learning outcomes in science.

This raises the question: Who is a qualified teacher?

Darling- Hammond (2007) defined a qualified teacher as one who is fully certified and holds the equivalent of a major in the field being taught. They are people who are professionally trained and certified with the goal of impacting adequately into learners at different levels. A qualified chemistry teacher must then be skilled and adequately sound in the knowledge of chemistry and have obtained a certification as proof, and can also devise methods, systems and objectives to ensure that his or her learners get the best of Chemistry.

In Nigeria, the teaching education program is categorized in 3 levels based on their certification. They are:

1. The Nigeria Certificate in Education (NCE) runs for a minimum of three years and a maximum of five years.
2. Bachelor's Degree in Education (B.Ed, B.Sc. Ed, & B.A. Ed) programme runs for a minimum of three years and a maximum of five years;
3. Post-Graduate Diploma in Education (PGDE), which provides professional training for pre-service and in-service auxiliary teachers; M.Ed., and Ph.D.

Certain basic requirements are needed for teacher training before one can gainfully be certified as a qualified teacher. The major training influence for teacher qualification is in terms of the magnitude, type and quality of professional preparation put into it. This is to say, while the

academic qualification of the teacher may influence teachers' output, the particular kind and quality of pre-service and in-service exposure he has experienced is a crucial factor for consideration (Etiubon and Benson 2014). The education of a society at large is predicated on the quality of knowledge being passed from teachers to learners. Therefore, if quality chemistry education is to be achieved, much effort has to be put into the training and certification of teachers.

Adedayo (2012) examined the effects of teachers' qualifications on the performance of senior secondary school students in physics. The result showed that students taught by teachers with higher qualifications performed better than those taught by teachers with lower qualifications. Afangideh (2011) observed that professional preparation is needed by science teachers and chemistry teachers in particular, through adequate and informed exposure to courses for teaching effectively, as it influences students' performance. In addition to Afangideh (2011), one of the common characteristics of a teacher is that he knows more than the students. How does a teacher know more than his/her students if there is no exposure? The answer is not far-fetched. Emmah (1998) observed that adequately exposed teachers who employed probing questions, problem-solving skills, discussion and feedback during interaction performed significantly higher than teachers who lacked the exposure. An inexperienced, unexposed and inadequately trained teacher will perform poorly even when handed the best of curricula, environment and facilities. The National Teachers Institute (NTI) recently identified what could be regarded as the major problem responsible for the falling standards of education in the country. According to the NTI, about 54% of teachers in the country are underqualified to be engaged in the important job of imparting knowledge to the younger ones. The institute blamed this ugly trend on the inability of some local governments in the country to adhere to its standing

rule that only holders of a National Certificate in Education should be employed to teach at the primary school level. The northern part of the country is singled out as most guilty in violating the rule regarding the NCE certificate as the minimum qualification to teach in primary school. At the height of this appalling discovery, the Plateau State Education Reform Committee made a startling discovery that out of the 11,000 primary school teachers in the state, only 4,000 are qualified, leaving 7,000 unqualified to teach, and in Niger State, out of its 22,000 teachers, 7,000 of them were unqualified, and were not supposed to have been engaged in the first-place (Emmanuel, 2013).

A nation cannot be greater than its teachers. Therefore, it is expected that chemistry teachers at all levels of education possess pre-requisite qualifications before delving into the teaching of chemistry.

Studies on the Teachers' Experience of Teaching Chemistry in the School Chemistry Certificate

Teachers' experience and knowledge of subject matter are unique qualities for teaching effectiveness (Etiubon & Benson, 2014). It has to do with the increased awareness of diversifying search for new ideas, new commitments and new challenges.

Here, we can also discuss how long a teacher has been teaching and what qualifications a teacher has. According to Rice (2010), experience gained over time enhances the knowledge, skills, and productivity of workers. These qualities facilitate students' skills and abilities to think about chemistry processes useful for exploration and analysis, and also enable a thorough understanding of chemistry concepts. Experienced teachers are a great asset to novice teachers who need advice, encouragement and continuous guidance on how best knowledge can be imparted. Akinyele (2001) and Commey-Ras (2003) commented that experience improves teaching skills while students learn better at the hands of teachers who have taught them continuously over a period of years. Therefore, a newly certified Chemistry and Education student might find teaching a bit difficult and may need the help of a senior teacher in that same school. This is not to say he/she doesn't have the pedagogical knowledge, but the experience is lacking. Even though such a graduate underwent the observation and teaching practice exercise. The classroom setting is a very diverse place. Senechal (2010) found that teacher experience has a significant positive effect on student achievement, with more than half of the gains occurring during the teacher's first few years, but substantial gains occurring over subsequent years, albeit at a slower rate. This is not so for the new breed of teachers. In the words of Gibson & Dembo (1987), teachers without experience feel a sense of helplessness when it comes to dealing with unmotivated students.

Domike (2002) listed phase experiences in the teaching profession. He speculated that experiences in the teaching profession have to do with some elements. Elements such as: Exploration, Stabilization, Experimentation and Diversification.

- At the Exploration phase, he called it the period of survival, discovery and enthusiasm. It is between the first year of teaching for a beginning teacher and the fifth year.
- The Stabilization phase kicks in almost at the fourth year, and it usually tells how committed the teacher is to the teaching profession. With unattractive incentives, the teacher is interested in enhancing his educational attainment for greener pastures. Pedagogical mastery is identified and pursued with vigour and greater flexibility applied.
- The Experimentation phase is from the fifth year to the tenth year. Most of all beginning teachers have shipwrecks and a lot of trials and errors at this phase by application of instructional methods, student management with their individual differences and lots more.
- The Diversification phase is between 15 years and 25 years of teaching. Teachers begin to look into diversifying and doing something a little outside of their profession. It is very much considered, but unlikely to change careers. This is mostly because at this phase, they understand the nitty-gritty of teaching, and they are more direct in their approach. Experience, they say, is the best teacher. They have been taught and mastered by experience.

With 26-33 years of professional experience, some teachers achieve serenity and greater confidence to invest in teaching. To this end, Load and Sorensen (2014) opined that the Chemistry teachers' year of experience is important in selecting appropriate learning experiences and effective instructional approaches for improving achievement in Chemistry.

Studies on the Teaching Methods used in Teaching Electrolysis

The way knowledge is being passed is as important as who is passing it and vice versa. Employing the appropriate teaching method is highly dependent on the teacher passing the knowledge. This means the teacher must have sufficient knowledge of the topic content and the prospective teaching methods they can use. Awoniyi (2006) added that teachers need to be many things: a source of information and a guide, an organizer of opportunities for learning, someone who can structure a suitable environment for learning, a superior and a consultant. Teachers need to be aware of current innovations in teaching so as to determine which method is most appropriate for a particular situation.

Information and communication technology (ICT) offers an exciting new world for students and teachers. It offers many possibilities for planning lessons, as well as for their management (Grimaldi and Rapuano, 2009). ICT can be divided into two groups: the first group consists of computers used as tools for finding information, communicating with others, and accessing multimedia; the second group includes scientific tools such as virtual laboratories or interactive simulations. There are some advantages to the use of computers in science subjects, particularly chemistry. Psychology researchers have found that an understanding of chemistry includes the ability to think on three levels: the macroscopic level, the symbolic level and the level of particles (Johnstone, 1991). Students and pupils have the most difficulty understanding the submicroscopic level - the level of particles, because it reaches beyond their experience. In these cases, interactive multimedia can be used as an effective tool. Multimedia demonstrations should not replace other methods for teaching chemistry. The use of multimedia and virtual laboratories for teaching chemistry improves teaching because it allows integration of three levels of understanding of chemistry: visualisation and simulation of processes.

Chemical education has evolved over time, and new methods of teaching have been developed. Many instructors have chosen to adopt an alternative pedagogy in recent years because they see it as a more effective way to reach their students. However, some people worry about whether the material's content will be sacrificed if an instructor chooses to use an alternative method. S.C. Okonkwo (2002) opined that there is a consensus among psychologists and educationists that a teaching method can exert considerable influence on students' intellectual development. In a study by Avwiri (2011), he concluded that there are several approaches/methods of teaching to inculcate and give students insight during instructional processes. So far, many studies have been carried out in education pertaining to the approaches/methods of teaching chemistry. However, it is not generally acceptable that all the methods are suitable for the teaching of the subject. It has been observed that the poor enrolment of students in chemistry in our secondary schools and tertiary institutions was a result of the way students' backgrounds were laid.

Educational technologies can also help teachers make appropriate changes to the curriculum. Some of these tools can be used in class, allowing for real-time adjustments to a lesson; others alert students to errors in their thinking. Many assistive technologies are available to enhance the learning experience for students with disabilities. Educational technology has the power to enhance communication by allowing parents and students alike access to research and resources beyond the walls of their school.

Finally, teachers must stay current on the ever-evolving tools of educational technology and choose those that are most useful in terms of the value they might add to the chemistry curriculum (Avwiri 2011).

Studies on the Availability and Adequacy of Instructional Materials in Teaching Electrolysis

Instructional materials serve as a channel between the teacher and the students in delivering instructions. They may also serve as the motivation for the teaching-learning process (Stephen and Isaac 2013). Chemistry is an abstract science subject which involves a lot of activities. To this end, it is important to use instructional materials to galvanize or bridge the gap between the abstract and the concrete. Stephen and Isaac added that the mastery of chemistry cannot be fully achieved without the use of instructional materials. It will ultimately result in poor performance.

Basssey (2002) described instructional media as a system component that may be used as part of the instructional process, which is used to disseminate informative messages and ideas. They make communication possible in the teaching-learning process. Over the years, teachers have been known to have a want of words in conveying some chemistry terminology. Those who have spent a long number of years teaching have found that the use of instructional materials was a lifesaver in conveying their messages.

Today, advances in technology have made the teaching of electrolysis easier. It has also reduced the excessive talking of teachers in trying to explain a term in chemistry on the blackboard. Stephen and Isaac call it the Chalk-Talk method.

One of such advancements is the use of 3D models in the explanation of cathodes, anodes, atom, and their components. Instead of a teacher drawing a flat diagram on the board, the model depicts the minuscule details of an atom. These models are also used in explaining topics such as Stereochemistry, Electrolysis, Polymerization and the various bonding principles.

The synergy between what a student sees and touches is a great way to learn. So, more than just the drawing, can they feel it? There is an experience it imprints in their consciousness that makes the teaching sink. For example, if an SSS1 student is being taught laboratory equipment, inasmuch as diagrams can pass the message across, greater understanding can be achieved if the materials are available to see and to touch. The use of instructional materials cannot be glossed over, nor can it be overemphasised. Years of research studies have shown that where instructional materials are used, learning environments are highly stimulating and the students appear to take greater interest in learning.

However, some studies on the availability and utilization of instructional materials for teaching electrolysis have been reported in contradictory manners (Lawrence, 2017). For instance, Ifeakor (2006) found out that some material resources were available and adequate but were partly used in teaching and learning chemistry, while Nnorom (2012) and Achimugu (2016) reported that most instructional materials for teaching science were neither available nor utilised for the teaching-learning process.

In a study conducted by Dr. Lawrence (2017), he found that most of the laboratory equipment and audio instructional materials were available, but some were not utilized for teaching electrolysis. He added that visual instructional materials were neither available nor utilized for teaching electrolysis, which indicates that factors such as: lack of funds, lack of political will of the government in power, mismanagement of education funds, lack of in-service training, and lack of motivation of teachers inhibit effective provision and utilization instructional materials for teaching electrolysis

In the use of instructional materials, Erfan (2017) added that it is important to inculcate local wisdom. She further discussed that instructional materials can be adjusted to the concept

taught and made at an affordable cost. Instructional materials used in Electrolysis can help to relate chemistry to the phenomena occurring in everyday life. For example, the use of salt and battery cells. Erfan added that local wisdom is a particular characteristic which comes from a district or region that has cultural value developed within local people from generation to generation (Meliono, 2011). Local wisdom around the students can help students understand the relationship between their life-world and what they are learning in science. Through local wisdom, students can learn the values of the culture and sense of nationalism that may affect learning outcomes (attitudes, behaviour, and thinking ability). Knowledge of local wisdom needs to be integrated into the science learning process to improve the students' understanding of the learning materials related to the surrounding environment

Studies on the Influence of Practical Experiments Required in Electrolysis

Okam and Zakari (2017) described that Practical work has been able to promote students' positive attitudes and enhance motivation for effective learning in science. Hinneh (2017) added that when students are positively disposed to practical experiments, they attain meaningful success in their studies. The goals of practical work are to improve students' understanding, develop their skills in solving problems and understand the nature of science by replicating the actions of scientists. Sotiriou, Bybee and Bogner (2017) stated that: "While solving a scientific problem, students should act like scientists and follow scientific processes." Tsakeni (2018) explored access to effective practical work for physical sciences learners in two South African high schools. The results revealed that the absence of practical experiments resulted in learners who did not have a firm grip of concepts in Electrolysis. Tsakeni indicated that this finding led to a social justice agenda due to the high expectations linked to studying physical sciences. Tsakeni

recommended supporting practical work through the processes of assessment and tools for instructional leadership.

In light of the United Arab Emirates (UAE) 2021 vision to progress as a nation and invest in its youth in hopes of becoming one of the highest in the world in reading, mathematics and science, the country has recently made major developments in the education system (UAE Vision 2021, n.d). In an effort to work towards achieving the vision, the emirate of Abu Dhabi, in particular, has recently made drastic changes in its education system in terms of teacher qualifications and classroom practices (McKnight, Yarbro, Graybeal & Graybeal, 2016) while placing an emphasis on developing 21st century skills and preparing students to enter the modern market.

In Edgar Dale Cone of Experience, he postulated that people generally remember 50% of what they say as they do a thing. This would mean that a practical experiment in the teaching of Electrolysis is a surefire way of retention for learners.

Chemists and biologists study the structure of matter, composition, properties and the interaction between different elements. They make sure students understand what their surroundings are made of and how they work (Zuhrieh & Enas, 2020). However, many students find these subjects hard to learn because there is so much information about materials and their properties that has to be understood in order to understand change as it occurs. Students need practical applications and experiments at each stage in order to truly understand how everything in the world works.

Abdi (2014) stated that the experimental groups had a much greater understanding of the information covered, especially regarding questions that required interpretation. Hofstein and Mamlok-Naaman (2007) also added that laboratory work plays an important role in science

education and also helps in understanding the difference between observation and presentation of data.

Studies on the availability of relevant chemistry textbooks in Teaching Electrolysis

Textbooks are representative samples of the time they are written in, for they reflect the trends and principles that existed in a particular area of education (V. D. Milanovic, D. D. Trivic, 2015) In a way, they are built into the generations of students to whom they were taught, for it is through them that a certain way of thinking, a strategy of learning, general intellectual skills and habits, one's attitude towards that which is being learned, towards science and knowledge in general, is cultivated (B. I. Tomasevic, 2015).

The availability of relevant textbooks in teaching Electrolysis should not be underestimated, considering the fact that the textbooks play a vital role in determining course curricula (Smith & Jacobs, 2003; Koseoglu et al., 2003). (Norris & Phillips, 2003) opined that textbooks that use effective teaching strategies improve students' learning and provide good models for teaching. Over the past couple of years, it has been observed that one of the factors that contributes to the achievement of a high retention rate in Electrolysis is the availability of relevant chemistry textbooks. Like many others, Ocho (1997) also observed that students who had access to relevant chemistry textbooks achieved better in Electrolysis than students who did not.

Also, the thought process that says access to relevant chemistry textbooks influences students' performance is also largely determinant on three things:

1 is teacher-centred,

2 is student-centred and

3 is textbook-centred.

If the school is well equipped with relevant chemistry textbooks but the available teacher is not qualified and neither does s/he have the experience, there will be an underutilization of the textbooks. On the other hand, if the school doesn't have the necessary textbooks to facilitate learning, the teacher can only try. Expected results will not be fully achieved.

The second argument is premised on students. How readable do they find these textbooks? Do they help them in their learning processes at all? Do they even understand how to use these textbooks in the first place?

The last argument is textbook-centred. Who wrote these textbooks? Are they verified? Have the textbooks been put under adequate scrutiny? All of these questions are put into consideration when discussing the relevant chemistry textbooks for teaching Electrolysis.

Appraisal of Literature Review

This study sought to investigate the teaching of Electrolysis in Senior Secondary Schools. As Morrison (1934) defined, teaching is an intimate contact between a more mature personality and a less mature one, which is designed to further the education of the latter. This could be manifested in the classroom setting in which the teacher is the more mature personality and the student is seen as the less mature one who seeks to further be enlightened.

In this context, the teaching of Chemistry is explored. More directly, the teaching of Electrolysis. The West African Examination Commission (WAEC) has noticed a decline in the performance of students in external exams. Between 2006 and 2012, it was noted by the WAEC Chief Examiner that the poor performance is attributed to low levels of communication skills, inadequate practical exposure, poor quantitative skills, inability to relate concepts in Chemistry to everyday life and lack of understanding of some Chemistry concepts.

The study of Electrolysis is a necessary topic in Chemistry for all senior secondary schools across the globe. It's a general topic. Some Nigerian literature was reviewed, but much more, this has been done to ascertain the study in a more direct approach. By dissecting our local literature in comparison with foreign literature, this study has been geared towards enhancing further research studies on the teaching of Electrolysis in Senior Secondary schools in Iseyin Local Government, Oyo State, Nigeria.

However, this study will not only help in the teaching of Electrolysis but also in:

- helping students who find chemistry too abstract. This would improve performance in examinations (internal and external).
- understanding how the teachers' experience contributes to overall learning outcomes.
- informing curriculum developers and secondary school stakeholders on the teaching methods applicable to the newer generation of students.
- helping teachers see how best to make use of instructional materials and local wisdom to help make their teaching more concrete and comprehensible.
- showing the importance of adequate practical experiment for the teaching of Electrolysis.
- informing textbook authors and publishing houses on how to make the content more student-friendly and easy to comprehend and use at will.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter describes the Research Type, the Population, Sample and Sampling Technique, Research Instrument, Validation and Reliability of the Instrument, Procedure for Data Collection and Data Analysis Technique.

Research Type

The research type for this study is a descriptive research of the survey type. It is not a performance or experimental research but an achievement study. That is, it stands upon the accurate collection of data on the teaching of Electrolysis in School Certificate Chemistry in Iseyin Local Government, Oyo State. This gives us an understanding of the current situation of research problems in the teaching of Electrolysis.

Population, Sample and Sampling Technique

The population for this study consists of all Senior Secondary School teachers in Oyo State. The sample includes SS II teachers of chemistry from all secondary schools in Iseyin Local Government, comprising private and public schools. All sample schools are co-educational schools. The purposive sampling technique was used to select the school teachers.

Demographic Distribution (School Type)

All the demographic data of the respondents are presented in Table 1. On the School type distribution of the respondents, the table shows that 21 (46.7%) of the respondents are public school teachers, while 24 (53.3%) of the respondents are private school teachers.

Table 1: *Analysis Showing the Demographic Characteristics of Respondents (School Type)*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Public	21	46.7	46.7	46.7
	Private	24	53.3	53.3	100.0
	Total	45	100.0	100.0	

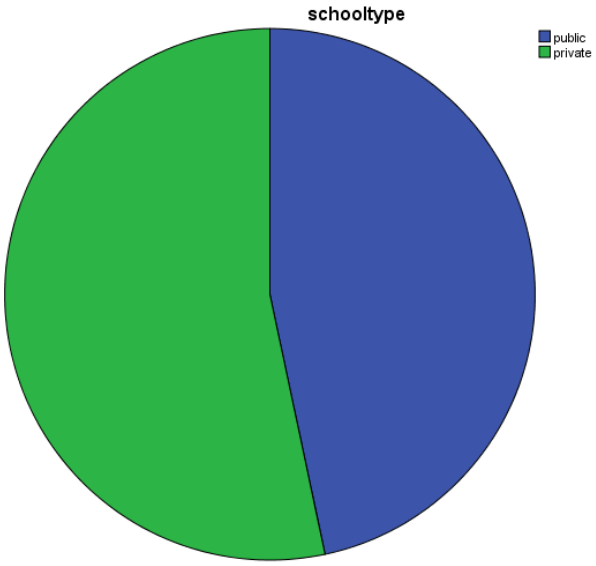

Figure 1: *A Pie Chart Showing the Demographic Characteristics of Respondents (School Type)*

Research Instrument

The research instrument for this study is Questionnaire. The carefully designed instrument was used to collect relevant data for the research from the teachers. The questionnaire consists of two (2) parts; Part 1 contains the demographic data of the respondents, while Part 2 contains items carefully organized with respect to the research question raised.

Validation and Reliability of Research Instrument

An instrument is said to be valid when it accurately measures the quality of what it is to be measured. In this study, the face and content validity were established by the supervisor for assessment and endorsement after necessary corrections. It was also given to three other lecturers in the Department of Science Education for validation. The corrections and suggestions given were used to improve the nature and scope of the final copy of the questionnaire. The reliability of a research instrument has to do with the consistency in being able to produce the same result repeatedly. This was carried out outside of the researcher's area of study, i.e., a coeducational school located outside Iseyin.

Procedure for Data Collection

A consent form was obtained from the faculty Head of department and was taken to each school. The questionnaire titled "Questionnaire on the Teaching of Electrolysis in Iseyin Local Government Area of Oyo State" was then administered by the researcher.

The researcher visited each of the sample schools and sought permission from the school administrators, and administered the instrument. The respondents were given adequate time to answer the questionnaire, and questionnaires were retried on the spot. The questionnaires were then subjected to analysis. Also, there was no coercion on any teacher who chose not to take part in the exercise. For those who participated in the exercise, their privacy was strictly respected.

Data Analyses Techniques

The research study employed the use of IBM SPSS Statistics 23 in order to perform data analysis.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND PRESENTATION

The results of the study are presented in this chapter. The focus of the study was to carry out an investigation into the teaching of Electrolysis in School certificate Chemistry in Iseyin Local Government, Oyo State. A total of forty-five responses were obtained from the study research. The questionnaires used to carry out this research were drawn from the research questions. The data analyses therein are based on the information obtained from administering the questionnaires. The data were analyzed using frequency counts and percentages.

Answering Research Questions

Research Question 1: What are the qualifications of the teachers teaching chemistry in Iseyin Local Government Area?

The information presented in Table 2 and Figure 2 reveals the qualifications of chemistry teachers in the Iseyin Local Government Area. The table shows that 3 (6.7%) teachers hold an NCE qualification, while another set of 3 (6.7%) teachers hold a B.Ed qualification. A total number of 12 (26.7%) teachers hold a B.Sc + PGDE qualification, while the remaining 27 (60.0%) hold a B.Sc (Ed) qualification.

Table 2: *Analysis showing the qualifications of teaching chemistry in Iseyin Local Government Area*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NCE	3	6.7	6.7	6.7
	B.Ed	3	6.7	6.7	13.3
	B.Sc + PGDE	12	26.7	26.7	40.0
	B.Sc (Ed)	27	60.0	60.0	100.0
	Total	45	100.0	100.0	

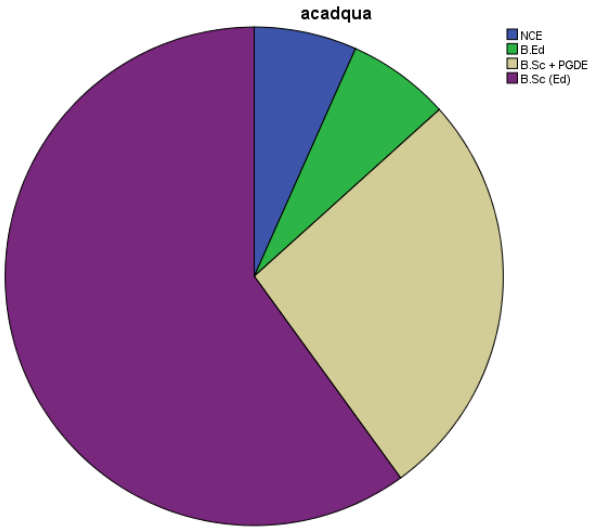

Figure 2: *A Pie-chart showing the Academic qualifications of teaching chemistry in Iseyin Local Government Area*

Research Question 2: How experienced are the teachers teaching chemistry in Iseyin Local Government Area?

Table 3 and Figure 3 reveal the following to be the experiences of chemistry teachers in Iseyin Local Government area;

- 18 (40.0%) teachers have teaching experience between 0 - 5 years
- 6 (13.3%) of the respondents have teaching experience between 5 - 10 years
- Only 3 (6.7%) respondents have teaching experience between 11 - 15 years
- Lastly, there are 18 (40.0%) teachers with experience above 15 years.

Table 3: *Analysis showing the experience of teachers teaching chemistry in Iseyin Local Government Area*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5	18	40.0	40.0	40.0
	6-10	6	13.3	13.3	53.3
	11-15	3	6.7	6.7	60.0
	Above 15	18	40.0	40.0	100.0
	Total	45	100.0	100.0	

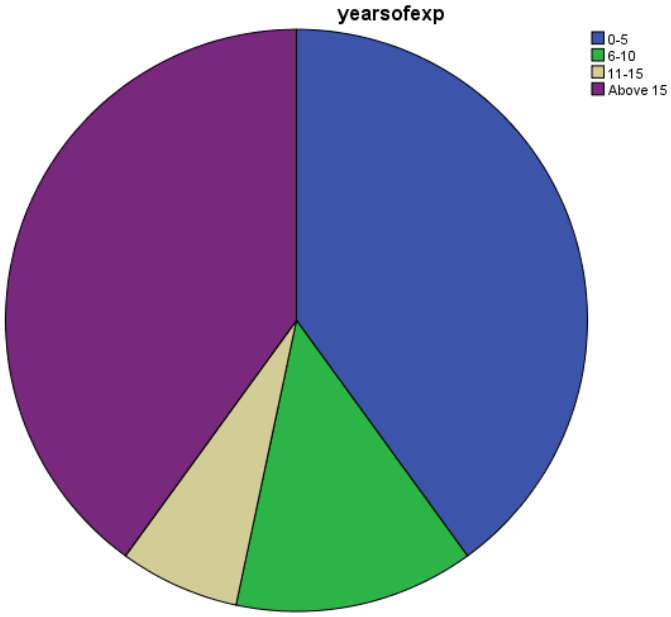

Figure 3: *A pie-chart showing the experience of chemistry teachers in Iseyin Local Government Area*

Research Question 3: Which teaching methods do teachers engage in teaching Electrolysis in Iseyin Local Government Area?

The teaching methods of teachers employed in teaching electrolysis are recorded in this section. Table 4 and figure 4 shows the extracted result and we observe that:

- the largest percentage (46.7%) of teachers use the demonstration method
- 33.3% of teachers use the lecture method
- 13.3% use the discussion method, while
- Only 6.7% teachers use the laboratory method

Table 4: *Analysis of Electrolysis teaching methods in teaching in Iseyin Local Government Area*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	lecture method	15	33.3	33.3	33.3
	demonstration	21	46.7	46.7	80.0
	discussion	6	13.3	13.3	93.3
	laboratory	3	6.7	6.7	100.0
	Total	45	100.0	100.0	

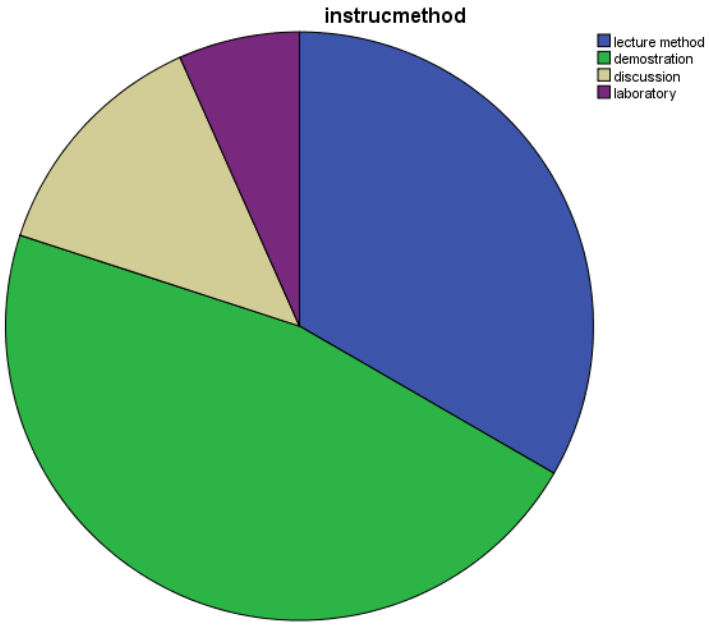

Figure 4: *A pie-chart showing Electrolysis teaching methods in Iseyin Local Government Area*

Research Question 4 & 5: Are the required instructional materials for the teaching of Electrolysis in Iseyin Local Government Area available? How adequate are they?

There is a total of 6 required instructional materials in the questionnaire. They are:

- An electrolytic cell apparatus
- Hoffman's Voltameter
- An electrochemical cell apparatus
- Copper Sulphate Solution
- Brine
- Dilute H_2SO_4

The availability of these instructional materials for teaching Electrolysis is depicted in Table 5 (1-6) below:

From Table 5.1, we observe that only 18 (40%) respondents have the electrolytic cell apparatus for teaching electrolysis, and only 3 (6.7%) indicated that it is adequately available.

Table 5.1: *An analysis of the availability of an electrolytic cell apparatus*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Available	18	40.0	40.0	40.0
	Non Available	15	33.3	33.3	73.3
	Adequate	3	6.7	6.7	80.0
	non adequate	9	20.0	20.0	100.0
	Total	45	100.0	100.0	

From table 5.2, only 6 (13.3%) respondents have Hoffman's Voltameter for the teaching of Electrolysis, and 6 (13.3%) indicated that the apparatus is adequately available.

Table 5.2: *An analysis of the availability of Hoffman's Voltameter*

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Available	6	13.3	13.3	13.3
	non available	33	73.3	73.3	86.7
	adequate	6	13.3	13.3	100.0
	Total	45	100.0	100.0	

From Table 5.3, 16 (40.0%) respondents indicated the availability of an electrochemical cell apparatus. Only 6 (13.3%) indicated that the apparatus is adequately available.

Table 5.3: *An analysis of the availability of an electrolytic cell apparatus*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	available	18	40.0	40.0	40.0
	non available	21	46.7	46.7	86.7
	non adequate	6	13.3	13.3	100.0
	Total	45	100.0	100.0	

From table 5.4, 21 (46.7%) respondents indicated the availability of Copper Sulphate Solution and only 9 (20.0%) indicated that the apparatus is adequately available.

Table 5.4: *An analysis of the availability of Copper Sulphate Solution*

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	available	21	46.7	46.7	46.7
	non available	15	33.3	33.3	80.0
	adequate	9	20.0	20.0	100.0
	Total	45	100.0	100.0	

From table 5.5, 30 (66.7%) respondents indicated the availability of Brine, while the remaining 15 (33.3%) indicated its unavailability.

Table 5.5: *An analysis of the availability of Brine*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	available	30	66.7	66.7	66.7
	non available	15	33.3	33.3	100.0
	Total	45	100.0	100.0	

From table 5.6, 33 (73.3%) respondents indicated the availability of Dilute H_2SO_4 and only 6 (13.3%) indicated that the apparatus is adequately available.

Table 5.6: *An analysis of the availability of H_2SO_4*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	available	33	73.3	73.3	73.3
	non available	6	13.3	13.3	86.7
	adequate	6	13.3	13.3	100.0
	Total	45	100.0	100.0	

Research Question 6: Are the practical experiments required in Electrolysis performed in secondary schools in Iseyin Local Government?

For this section, the research question was divided into 3 parts, and they are:

- Is any practical experiment performed for the teaching of Electrolysis?

- If yes, on average, how many practical experiments are performed in the teaching of electrolysis?
- Is the number of practical experiments conducted adequate for the teaching of Electrolysis?

For the first part of the question, which aims to find out if any practical experiment is performed, we observed that only 21 (46.7%) conduct an experiment on electrolysis for their pupils. This data is shown in Table 6a below.

Table 6: *An analysis of whether any practical experiment is performed*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	21	46.7	46.7	46.7
	no	24	53.3	53.3	100.0
	Total	45	100.0	100.0	

Part 2 of the research question probes further into the average number of practicals performed by those who responded “yes” in part 1.

The data in Tables 6.1.1 and 6.1.2 show that, on average, practicals are conducted 4 times during the teaching of Electrolysis.

Table 6.1: *An analysis of the average number of experiments conducted*

Table 6.1.1 Mean

N	**Valid**	**45**
	Missing	**0**
Mean		4.4667
Std. Deviation		1.84144

Table 6.1.2 An analysis showing the adequacy of experiments in teaching electrolysis

				Valid	
		Frequency	**Percent**	**Percent**	**Cumulative Percent**
Valid	once	3	6.7	6.7	6.7
	twice	9	20.0	20.0	26.7
	quadruple	9	20.0	20.0	46.7
	none	24	53.3	53.3	100.0
	Total	45	100.0	100.0	

The third and last part of the research question asks the respondents if the number of experiments conducted is adequate for their teaching of Electrolysis. The data in Table 6.2 shows 15 (33.3%) YESes and 30 (66.6%) NOs.

Table 6.2: *An analysis showing the adequacy of the number of practical experiments*

				Cumulative
	Frequency	**Percent**	**Valid Percent**	**Percent**

Valid	yes	15	33.3	33.3	33.3
	no	30	66.7	66.7	100.0
	Total	45	100.0	100.0	

Research Question 7: Do students have access to relevant Chemistry textbooks that treat the topic of Electrolysis?

A list of textbooks was listed in the questionnaire, but only 2 which are required for the secondary school certificate chemistry, are focused on. They are:

- New school chemistry - Osei Yaw Ababio
- Essential chemistry textbook - Odesina I. A

The data in Table 6 shows that 45 respondents have access to at least one of the relevant textbooks for teaching Electrolysis. 33 (73.3%) have access to the New School Chemistry textbook, while 12 (26.7%) have access to the Essential Chemistry textbook.

Table 7: *An analysis showing the availability of relevant textbooks in teaching Electrolysis*

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	New school chemistry.	33	73.3	73.3	73.3
	Essential chemistry.	12	26.7	26.7	100.0
	Total	45	100.0	100.0	

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The research study was aimed at investigating the teaching of Electrolysis in school certificate chemistry in Iseyin Local Government, Oyo State, Nigeria.

Discussion

The study by Adebayo (2012) examined the effects of teachers' qualifications on the performance of senior secondary school students in Physics. The result showed that students taught by teachers with higher qualifications performed better than those taught by teachers with lower qualifications. This correlates with the findings according to the National Teachers Institute, which states that about 54% of teachers in the country are underqualified to be engaged in the important job of imparting knowledge to the young ones.

Etiubon and Benson (2014) discovered that teachers' experience and knowledge of subject matter are unique qualities for teaching effectiveness. This discovery is also similar to Rice (2010), who found that experience gained over time enhances the knowledge, skills, and productivity of workers. These qualities facilitate students' skills and abilities to think about chemistry processes useful for exploration and analysis, and also enable a thorough understanding of chemistry concepts. More so, experienced teachers are a great asset to teachers who are new on the job.

From the findings of Snenchal (2010), he observed that teacher experience has a significant positive effect on student achievement and should never be neglected. Domike (2002) further added that teacher experience is, in fact, in stages. The exploration, stabilization, experimentation and Diversification stage. Each stage represents a phase in a teacher's years of

experience, and they contribute to teaching. The exploration stage is the very early stages, while the diversification stage is the more lengthy years of experience.

Awoniyi (2006) stated that teachers need to do many things for their students. One of their functions is to devise an appropriate teaching method for their class. They know the category of students they teach, and they should be able to devise what works best for them. Are they very modern and acquainted with ICT? The teacher must be able to tailor the teaching methods to include the use of ICT. Avwiri (2011) added that teachers must be ever evolving just as the world is advancing.

The study of Stephen and Isaac (2013) showed that the mastery of chemistry cannot be fully achieved without the use of instructional materials. He added that instructional materials serve as a channel between the teacher and the students in delivering instructions and also serve as the motivation in the teaching-learning process. He noted that advancement in instructional materials aids the teachers in passing knowledge accurately. One such advancement is the use of 3D models in the explanation of the atom and its components. Instead of a teacher drawing a flat diagram on the board, the model depicts the minuscule details of an atom. These models are also used in explaining topics such as Stereochemistry, Polymerization and the various bonding principles.

Coupled with instructional materials comes practical equipment. They mostly work hand in hand, and we cannot talk about one without the other. Tsakeni (2008) recommended supporting practical work through the processes of assessment and tools for instructional leadership. This synchronizes with Erfan (2017), who said that inculcating local wisdom in

instructional methods and practical aid learning. Chemistry is embedded all around us, and if teachers can find their local expression, much can be achieved.

A good support for practical is the availability of required textbooks. If they are available at an affordable cost, students are able to obtain them and further their learning. When assignments are given by them, they have a quick reference. More so, publishing houses should take the role of technical writers; those who pick hard concepts, digest them and explain/write them in simple words without losing the original intent or values.

Conclusion

The study concluded that;

1. Teacher's qualification, experience, teaching methods, instructional materials, practical experiments and availability of Chemistry textbooks are required for the successful teaching of Electrolysis.
2. The study has revealed that more than half of those who teach Electrolysis in Iseyin hold a B.Sc. (Ed) certificate. This is to say that they must have gone through the necessary training to become secondary school teachers.
3. Experience, they say, is the best teacher, and the results show that there are sufficient experienced teachers in Iseyin who can be of help to fresh and inexperienced teachers.
4. The top recommendation for teaching Electrolysis is the Demonstration method, and the result shows that a good number of teachers in Iseyin use this method in teaching students.
5. Instructional materials come in very handy when teaching Electrolysis and for practical experiments. From the analyses, there is an imbalance in the availability and adequacy of instructional materials, and this will greatly affect knowledge delivery.

6. There are two recommended textbooks for teaching Electrolysis. They are;

- New school chemistry - Osei Yaw Ababio
- Essential chemistry textbook - Odesina I. A

The study revealed that all respondents have at least 1 of the recommended textbooks.

Recommendations

On the basis of the results obtained from this study, the following recommendations are considered appropriate:

1. Qualified teachers with several years of experience should do a hands-on workshop for new intakes, especially student teachers.
2. The use of the demonstration method should be employed by every teacher in the teaching of Electrolysis.
3. Private school owners and the Ministry of Education should ensure that instructional materials are made adequately available for the teaching of Electrolysis in senior secondary schools in Iseyin Local Government.
4. In order to have an in-depth understanding of Electrolysis, practical experiments must be adequately carried out.
5. Public and private schools should be furnished with the required textbooks for the teaching of Electrolysis in Iseyin local government.

REFERENCES

Obinna, I.P. (2007). *The role of effective teaching in curriculum implementation. Nigerian Journal of Curriculum Studies 14(2)*

Kanno, T.N. (2004). *Teaching practice, microteaching and methodology of education in Nigeria. Owerri: Logicgate Publishers.*

Onwuka, U. (1984). *Curriculum development for Africa. Onitsha: Africana FEP Publishers Ltd.*

Offiong, A.A. (2005). *Implementation of agricultural science curriculum in secondary schools for vocational impact in Nigerian Journal of Curriculum Studies 12(2), 229 – 232.*

Dike, H.I. (1987). *Production and utilization of educational technology materials in Nigerian. Journal of Research in Education. 4(2), 12-19*

J. E. Upahi and A.S. Olorundare, Ph.D (2012). *Difficulties faced by Nigerian Senior School Chemistry Students in Solving Stoichiometric Problems 181*

Igwe, I. O. (2002). *Relative effect of framing and team-assisted instructional strategies on students' learning outcomes in selected difficult chemistry concepts in parts of Ibadan. Unpublished Ph.D Thesis of Teacher Education Department, University Of Ibadan.*

Garnett, P. J., & Treagust, D. F. (1992a). *Conceptual difficulties experienced by senior High school students of electrochemistry: Electric circuits and oxidation-Reduction equations. Journal of Research in Science Teaching, 29(2), 121-142.*

Garnett, P. J., & Treagust, D. F. (1992b). *Conceptual difficulties experienced by senior High school students of electrochemistry: Electrochemical (galvanic) and Electrolytic cells. Journal of Research in Science Teaching, 29(10), 1079-1099.*

Acar, B. & Tarhan, L. (2007). *Effect of cooperative learning strategies on student's Understanding of concepts in electrochemistry. International Journal of Science and Mathematics Education, 5, 349-373.*

Nordin, A. & Chong, M.N. (2010). *Pemahaman konsep pelajar tingkatan empat dalam topik Elektrokimia di daerah Skudai, Johor. [Form four students' conceptual understanding In the topic of electrochemistry in Skudai, Johor]. Retrieved on March 26, 2013 From http://eprints.utm.my/11277/*

Anita Yung Li BONG & Tien Tien LEE (2016). *Form four students' misconceptions in electrolysis of molten compounds and aqueous solutions, Asia-Pacific Forum on Science Learning and Teaching, Volume 17, Issue 1, Article 8 (Jun., 2016)*

Acar, B. & Tarhan, L. (2007). *Effect of cooperative learning strategies on student's Understanding of concepts in electrochemistry. International Journal of Science and Mathematics Education, 5, 349-373.*

Erduran, S. (2002). *Philosophy of chemistry in the curriculum. In S. Gatt (Ed.) Proceedings of the Conference Linking Science, Technology and Mathematics Education and their Social Relevance, Commonwealth Association for Science, Technology and Mathematics Education, 166-180.*

Bodner, G. M. J. *Chem. Educ. 1986, 63, 873. J. Chem. Educ. 1986, 63, 10, 873 Publication Date: October 1, 1986*

Resnick, L. B. Science (1983) 220, 477–478. Mathematics and Science Learning: A New Conception

Lawson, A. E. (1995). *Science Teaching and the Development of Thinking; Wadsworth: Belmont, CA.*

Gunstone, R. F. (1994). *In In The Content of Science: A Constructivist Approach to Its Teaching and Learning; Fensham, P. J.;Gunstone, R. F.; White, R. T., Eds.; Falmer: London; Pp 131–146.*

Emmanuel Nkemakolam OKWUDUBA, Ebele Chinelo OKIGBO (2018). *Effect of Teaching Methods on students' academic performance in Chemistry in Nigeria. Meta-analytic Review..*

Meliha Zejnilagic-Hajric and Ines Nuic (2015). *Demonstration in Teaching Chemistry: The Case of Two High-Schools from Sarajevo Canton.*

Shenelle Pearl Ghulam (2014). *Teaching Electrolysis in a way that Enhances Problem Solving, Analytical and Communicative Skills.*

Kaisa Jokiranta (2014). *The Effectiveness of Practical Work in Science Education Bachelor's Thesis.*

Dr. K. O. Aluko (2008). *Teaching Chemistry in Secondary Schools: A Case for Cooperative Instructional Strategy.*

Yazachew Alemu Tenaw (2014). *Effective strategies for teaching chemistry.*

Avwiri, E. H (2011). *Approaches for effective teaching of chemistry in Nigerian secondary schools*.

Olga L. S (2021). *Methodology in chemistry teaching: towards practical class organization in higher school.*

Uğur Taşdelen and Fitnat Köseoğlu (2008). *Learner-Friendly Textbooks: Chemistry Texts Based on a Constructivist View of Learning.*

Erfan Priyambodo and Safira Wulaningrum (2017). *Using Chemistry Teaching Aids Based Local Wisdom as an Alternative Media for Chemistry Teaching and Learning.*

Dr. Lawrence A(2017). *Availability and Utilization of Instructional Materials for Teaching Chemistry in Senior Secondary Schools.*

V. D. Milanovic, D. D. Trivic, B. I. Tomasevic, J. Serb. Chem. Soc. (2015). *doi: 10.2298/JSC140926052M.*

Cecil H. A (1940). *In-Service Training of Teachers in Review of Educational Research; 10: 210–215.*

E. Otor, et al., (2015) *"Influence of improvisedteaching instructional materials on chemistry students' performance in senior secondary schools in Vandeikya Local Government Area of Benue State, Nigeria," International Research in Education, vol/issue: 3(1), pp. 111-118.*

E. van Rossum and R. Hamer, (2010) *"The meaning of learning and knowing," Sense Publishers.*

S. Gustami, et al., (2014) *"Craft arts and tourism in ceramic art village of Kasongan in Yogyakarta," Journal of Arts and Hummanities, vol/issue: 3(2), pp. 37-50.*

M. Saritas, (2015) *"Chemistry teacher candidates' acceptance and opinions about virtual reality technology for molecular geometry," Educational Research and Reviews, vol/issue: 10(20), pp. 2745-2757.*

Nwachukwu, P. O. (2009). *Understanding Teachers Professional Competencies for Education Effectiveness. Owerri: Springfield Publishers Limited.*

Smith, B. D., & Jacobs, D. C. (2003). *TextRev: a window into how general and organic chemistry students use textbook resources. Journal of Chemical Education, 80, 99-102.*

APPENDIX

DEPARTMENT OF SCIENCE EDUCATION

UNIVERSITY OF ILORIN

ILORIN

QUESTIONNAIRE ON THE TEACHING OF ELECTROLYSIS IN ISEYIN LOCAL GOVERNMENT AREA OF OYO STATE

Dear respondent,

I am an undergraduate of Science Education (Chemistry) at the University of Ilorin. I am conducting a research study on the teaching of Electrolysis in secondary schools. Kindly respond to the items in this questionnaire. Your response will be used for research purposes only.

Thank you,

Fasasi, Muhammed Mosadoluwa.

SECTION A

Your academic qualification:

NCE ( ) B. Ed. ( ) B. Sc + PGDE ( ) B. Sc. (Ed.) ( ) M. Ed. /M. Sc. ( ) Ph. D ( )

Number of years of teaching experience

0 – 5 years ( ) 6 – 10 years ( )

11 – 15 years ( ) Above 15 years ( )

SECTION B

Instructional methods used in teaching Electrolysis

Please tick the instructional methods used in teaching the topic.

1. Lecture method ( )

2. Demonstration method ( )

3. Guide discovery method ( )

4. Discussion method ( )

5. Question and answer method (Socratic Method) ( )

6. Laboratory method or Experimental method ( )

7. Simulation and Games method ( )

8. Field-trip method ( )

9. Story telling method ( )

10. Project method ( )

11. Dramatic method ( )

12. The use of ICT ( )

13. Inquiry method ( )

SECTION C

Availability of instructional materials

SN	Instructional material	A	NA	AD	NAD
1	An electrolytic cell apparatus				
2	Hoffman's Voltammeter				
3	An electrochemical cell apparatus				
4	Copper Sulphate Solution				
5	Brine				
6	Dilute H_2SO_4				

A=Available NA=Not Available AD=Adequate NAD=Not Adequate

SECTION D

Conduct of Practical Experiments

Is any practical experiment performed for the teaching of Electrolysis?

Yes ( ) No ( )

If yes, on the average, how many practical experiments are performed in the teaching of Electrolysis

1( ) 2( ) 3( ) 4( ) 5( ) Above 5 ( )

Is the number of practical experiments conducted adequate for the teaching of Electrolysis?

Yes ( ) No ( )

SECTION E

Access to relevant Chemistry Textbooks that treat the topic of Electrolysis

Please tick the following School Certificate Chemistry Textbooks available in your area

1. New School Chemistry – Osei Yaw Ababio ( )
2. Essential Chemistry Textbook – Odesina I. A ( )
3. Lamlad SSCE & UTME Chemistry – F. O Ayinde ( )
4. Chemistry: A New Certificate Approach – S. 'Tunde Bajah & A. Godman ( )