



ATTITUDE OF TEACHERS TOWARDS UTILISATION OF LABORATORY METHOD FOR SENIOR SECONDARY SCHOOL CHEMISTRY CURRICULUM IMPLEMENTATION IN ENUGU EDUCATION ZONE, NIGERIA

Offorah, Beatrice Obianuju and Osuji, Gregory Ekene

Department of Educational Foundations, Faculty of Education

Godfrey Okoye University Ugwuomu-Nike, P.M.B. 01014, Thinkers' Corner, Enugu, Nigeria

obianuju@gouni.edu.ng; osujiekene@gouni.edu.ng

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Abstract: *The study assessed the utilization of laboratory method for Chemistry curriculum implementation in secondary schools in Enugu education zone of Enugu State, Nigeria. The study focused on the attitude of teachers of Chemistry towards the usage of laboratory method in the implementation of Chemistry curriculum, and the barriers to effective use of laboratory method in the implementation of the same curriculum. The study adopted quantitative paradigm, and specifically used descriptive survey research design. Two research questions and one hypothesis guided the study. The study was anchored on Vygotsky's Social Constructivist Learning Theory of 1978. The study targeted and studied all the 86 teachers of Chemistry in the education zone. Since the population was manageable, no sampling was done. A structured questionnaire was used to collect data. For data analysis, mean and standard deviation were used to answer the research questions while t-test statistics was used to test the hypothesis. Statistical Package for Social Sciences (IBM SPSS Statistics 21) aided in the analysis of the data. The findings of the study revealed that the teachers of Chemistry had negative attitude towards the use of laboratory method in teaching Chemistry. More so, that lack of laboratory materials posed hitch to the utilisation of laboratory method. The study concludes that the negative attitude of teachers towards laboratory method translated to the poor performance that students recorded in their standardised examinations. The study therefore recommended that principals should encourage teachers of Chemistry through seminars, conferences, and workshops on the need for the*

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utilisation of laboratory method in the implementation of Chemistry curriculum for improved students' performance.

Introduction

The inculcation of scientific skills and attitudes in students can only be achieved through the proper teaching of the various science subjects such as Chemistry, Biology, Physics, Mathematics, Health Science, Agricultural Science among others. As one of the science subjects, Chemistry studies the composition, structure and properties of matter, as well as the changes it undergoes during chemical reactions. Summarily, it can be said that Chemistry is the study of matter and matter is anything that has weight and occupies space. It is a core subject compulsory to all science students in secondary schools in Nigeria. Chemistry plays key role in industrialization and other sectors of the economy. It is a practical oriented subject which equips students with concepts and skills that are useful in solving the day-to-day problems of life. The study of Chemistry aims at providing the learner with necessary knowledge with which to control or change the environment for the benefit of an individual, family or community (Adibe, 2020). The study of Chemistry in senior secondary schools can equip students with the useful knowledge that will enable them face the challenges of life before and after graduation. If Chemistry is so important to the life of individuals and the nation, then the input into teaching and learning of Chemistry to enhance greater performance by the students should be of great concern. The Government policy that admission into the universities should be 60% of sciences and applied sciences and 40% arts and social sciences are often times not accomplished

because there are not enough students opting for science related courses (Ani, 2017).

Chemistry is an incredibly fascinating field of study, because it is so fundamental to the world. Chemistry plays a role in everyone's lives and touches almost every aspect of life existence in some way. Chemistry is essential for meeting humanity's basic needs of food, clothing, shelter, health, energy, clean air, water and soil. Chemical technologies enrich the quality of life in numerous ways by providing new solutions to problems in health and materials and energy usage (Ababio, 2016). Chemistry is the science of matter and the changes it undergoes under different conditions of temperature and pressure. The knowledge of Chemistry is necessary in the understanding of the composition, properties and behaviour changes of matter that form the environment around us. The knowledge can only be well established through a planned curriculum.

In this study, the researchers view curriculum as all the planned and guided learning experiences and intended learning outcomes formulated through systematic consideration and reconstruction of government content, instructional methods, instructional materials, classroom communication and evaluation devices for effective implementation of the senior secondary school government curriculum. Osuji and Oluoch-Suleh (2017) conceptualized curriculum as "planned and unplanned learning experiences of the learner under the auspices of the school and the society, which enables him or her to acquire sustainable knowledge, skills, values and positive attitudes for the formation of

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the heart and the transformation of the society, p.4.” The ability to put the curriculum into practice in the classroom is called curriculum implementation. After the curriculum has been planned with regards to identifying the objectives, selecting the contents, learning experiences and materials based on their assumed effectiveness in making it possible for the objective to be achieved, then the design is put into action. According to Mkpa (2017), the process of putting the curriculum into action or practices for the purpose of realizing the objectives is generally known as curriculum implementation. It is the actual use of the prescriptions in the curriculum for teaching the students, such as the structure, organization, balance and presentation of the content in the classroom. Curriculum implementation is a practice or instructional phase of the curriculum process where teachers and learners are involved in negotiation aimed at promoting learning. The teacher adopts the appropriate teaching methods, resources and strategies to guide learning. the learners on their own are actively involved in the process of interaction with learning activities.

Curriculum implementation as used in this study is the transmission of planned Chemistry curriculum into operational curriculum in the classroom. The Chemistry curriculum presents Chemistry as a practical subject where scientific concepts, principles and skills are developed through experimental investigations. The learning of scientific knowledge by laboratory method is encouraged. Innovating the Chemistry curriculum therefore, is necessary for meaningful and effective teaching of Chemistry through laboratory method as this would bridge the knowledge gap existing in the Chemistry

curriculum. A proper probe into the complete understanding of Chemistry cannot be achieved without the full utilization of the laboratory.

Laboratory is described as a room or building or a place where experimental studies are carried out. In the laboratory, students are engaged in a human enterprise of examining and explaining natural phenomena in a practical way. According to Ali (2011) a laboratory is a facility that provides controlled condition for scientific and technological research, experiment and measurement. Laboratory can be said to be a room or building equipped for scientific experiments, research, or teaching, or for the manufacture of drugs or chemicals. The author stressed that laboratory helps students to discover what they do not know yet and confirm the truth of the knowledge acquired in the classrooms. Laboratories used for scientific experiments and researches take two forms – indoor and outdoor laboratories. An indoor laboratory is a building or room furnished with different scientific equipment in various fields of science and engineering, while an outdoor laboratory is one outside the confined buildings or rooms. Typical examples of outdoor laboratories include ponds, forests, riversides and botanical gardens. In the laboratory, students have the opportunity to carry out experiments and other investigative activities (Ali, 2011).

Laboratory works are activities or investigations that are carried out in the laboratory which provide students the opportunities of becoming more knowledgeable and acquire science practical skills, which includes like observation, identification, classifying, hypothesizing, predicting, measuring and experimenting. Nzewi (2018) asserted that laboratory activities can be

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regarded as a strategy that could be adopted to make the task of teaching more real to the students as opposed to abstract or theoretical presentation of facts, principles and concepts of subject matters. The author further maintained that practical activities should engage the students in hands-on and minds-on activities, using varieties of instructional materials/equipment to drive the lesson home.

Laboratory activities have played a special and central role in science education for a long time. Science educators believe that engaging students in laboratory activities has many benefits: they stimulate creativity, curiosity and critical thinking, promote students' engagement with the scientific methods and encourage active learning and problem-solving approach (Lunetta, 2018). Laboratory activities also provide opportunities to collect and analyze data and apply mathematical knowledge to support and illustrate concepts, facts and principles (Garnett, 2015). Laboratory practical works provide a way not only for developing varieties of different practical skills but also developing favourable attitudes, interest, pleasure, enthusiasm, imitation, imagination and cooperation among students (Nworgu, 2015).

The chief examiners report over the years on students' performance in Chemistry have been worrisome. It was observed that some students couldn't identify the items in the Chemistry laboratory, not to talk about relating them to their studies. The teacher; male or female is the chief implementer of the Chemistry curriculum. Therefore, for the teacher to do justice to their work, and enhance students' performance in Chemistry, they should have positive attitudes towards the laboratory method of teaching and learning. There is also need to consider the

availability of the laboratory and its facilities for the proper implementation of Chemistry curriculum in secondary schools. Availability of laboratory and its facilities for teachers of Chemistry in secondary schools can solve problems of poor Chemistry curriculum implementation. Adebisi, Tewogbade and Olajide (2017) found that laboratory facilities help to improve science process skills by expanding the basis of inference and the ability to access large data base to activate learning. In line with this thought, Adeniyi (2011) observed that for effective Chemistry teaching to be promoted, laboratory facilities must be available in schools for utilization by teachers. Abimbade (2015) posited that lack of adequate funding in education is a barrier to availability of laboratory facilities in public secondary schools. This therefore makes some teachers not to be interested in making use of the laboratory method in the teaching of Chemistry, hence; poor performance of students in the subject. According to Adebisi, Tewogbade and Olajide (2017), laboratory facilities can be available, adequate but not utilized during science teaching. Here, the negative attitude of the teacher toward the laboratory method is a big factor. This is the reason this current study assesses the teacher's attitude towards the utilisation of the laboratory method in the implementation of Chemistry curriculum.

The significance of laboratory in science teaching abounds. Yara (2010) also lent credence to the significance of laboratory method in the learning of Chemistry. In the submission, Yara identified six major significance of laboratory method in promoting quality and effective learning of Chemistry as follows: motivating students by stimulating interest and enjoyment;

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teaching laboratory skills; assisting concept acquisition and development; developing and understanding of scientific inquiry and developing expertise in conducting inquiries; encouraging social skills development and inculcating the scientific attitudes Yara (2010) listed laboratory adequacy as one of the factors that affect the learning outcomes of students. In terms of academic achievement, Adeniran (2010) stated that laboratory instructional strategy gives a new approach to science teaching and learning because it provides a non-threatening, realistic and concrete approach to learning of Chemistry as opposed to the difficulty encountered in learning the formal, abstract treatment of the typical textbook. Oyedeji (2020) discovered that students taught Chemistry with laboratory method performed significantly better than those taught using the conventional lecture and text book method. The most effective vehicle by which the process of inquiry can be learned appears to be a laboratory method where the student experiences, first-hand, the inquiry process. Laboratory method has also been demonstrated to be effective means for comprehension, understanding and application of scientific knowledge.

Laboratory experiences provide opportunities for teachers of Chemistry to model best practices in the study of scientific concepts, including application of scientific methodologies, respect for life and the environment, inclusion of learners of all abilities, and consistent adherence to safety standards. Thus, study in a laboratory is an integral and essential part of Chemistry (Odubunni, 2011). Quality and effective teaching of Chemistry depends largely on adequate provision and proper utilization of instructional resources. A practical based approach to

Chemistry is the key and to breakthrough in Science and Technology advancement. Therefore, the current study assesses the utilization of laboratory method in the implementation of Chemistry curriculum in senior secondary schools in Enugu Education zone, Enugu State, Nigeria.

Statement of the Problem

Chemistry is considered one of the important science subjects because it is required to study several science courses in tertiary institutions. That notwithstanding, the way Chemistry is being taught in schools left much to be desired. Over the years, the performance of students in Chemistry in Nigeria secondary schools has been very poor. These poor performances in Chemistry are arguably as a result of poor implementation of the curriculum.

A glance, over the years, on the performance of students has not been very impressive from the West African Examination Council (WAEC) and National Examination Council (NECO) in Chemistry. The WAEC chief examiner's report in Chemistry specifies areas of students' weakness and the way forward to better performance in the subject. Areas of weakness highlighted include that many students of Chemistry cannot properly identify chemicals and reactants; properly mix in the appropriate amounts of substances in the laboratory. The teacher is a big factor here!

Continuous poor performance of the subject has created the need for more effective teaching method that can enhance curriculum implementation in Chemistry. The problem this study investigated; put in question form therefore is; what is the attitude of teachers of Chemistry towards the utilization of laboratory method in the implementation of senior secondary school Chemistry curriculum?

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Purpose of the Study

The main purpose of this study was to assess the utilisation of laboratory method in the implementation of Chemistry curriculum in senior secondary schools in Enugu Education zone, Enugu State, Nigeria. Specifically, the study sought to:

1. Find out the attitude of teachers of Chemistry towards the use of laboratory method in the teaching and learning of Chemistry.
2. Ascertain the barriers to effective use of laboratory method in the implementation of Chemistry curriculum.

Research Questions

The following research questions guided the study:

1. What is the attitude of teachers of Chemistry towards the use of laboratory method in teaching and learning Chemistry?
2. What are the barriers to effective use of laboratory method in the implementation of Chemistry curriculum?

Hypothesis

This null hypothesis guided the study:

Ho: There is no significant difference in the mean responses of male and female teachers of Chemistry on the use of Laboratory method in the implementation of senior secondary school Chemistry curriculum.

Theoretical Framework of the Study

This section discusses the theory that the study hinges on. The study was anchored on Vygotsky's Social Constructivist Learning Theory of 1962. Vygotsky is one amongst those who believe that children actively construct their knowledge. Vygotsky (1962) viewed cognitive development as a result of a dialectical process, where the child learns through shared problem-solving experiences with someone else, such as teachers,

parents, siblings and peers. As a social constructivist theorist, Vygotsky emphasizes the social contexts of learning and the fact that knowledge is mutually built and constructed. It also emphasizes the benefits of collaboration in group work and with a more skilled tutor; an individual will facilitate transition from learners' zone of proximal development to new levels of skills and competences. Zone of proximal development (ZPD) is Vygotsky's term for the range of tasks that are too difficult for children to master alone, but can be learnt with the guidance and assistance from adults or more skilled children working independently. This implies that the teacher of Chemistry should act as a facilitator by gradually withdrawing explanation, hints and demonstrations until the student is able to perform the skill alone. This will encourage the students to learn from previous knowledge they had before coming to school or the knowledge they already have to build the new knowledge.

Vygotsky's theory encourages social learning and recognizes that learning involving group work could improve students' academic achievement. Vygotsky (1962) emphasized that in the practical class the teacher of Chemistry is expected to sensitize learners to their environment, develop critical thinking, encourage creative thinking and encourage exploration that will enhance self directed and cooperative learning amongst the learners. Vygotsky theory is related to the present study because it supports the view that in laboratory, students interact with the materials or with one another in the course of practical work.

This theory plays an important function in education to guide students in learning the skills that are necessary in the culture in which they

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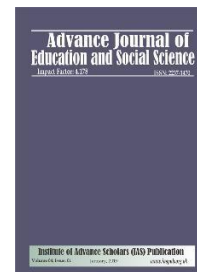
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live. The teacher according to Vygotsky's view should establish many opportunities for students to learn with the teacher and more skilful peers. In this respect it is evident from this theory that Chemistry should be taught in such a way that students will be able to apply the knowledge outside the classroom. Practical work in the laboratory can help achieve this. Looking at the constructivist theory as postulated by Vygotsky in the context of this study, we find that performance in Chemistry largely depends on the learner and the environment itself and then the interactions that exist between the learners. The implication of this is that the teacher of Chemistry must give the learners the opportunities to construct, produce and use experience that is meaningful to their understanding of the environment in which they live.

Methods

The study adopted the quantitative paradigm, specifically, the descriptive survey research design. The design enabled the researchers to describe the phenomenon in its entirety and effectively collect data without manipulating. The study was conducted in public senior secondary schools in Enugu Education Zone, Enugu State, Nigeria. The education zone consists of three local government areas namely Enugu East, Enugu North and Isiuzo. The choice of this area was as a result of the researchers' observations on students' performance in Chemistry over the years, and the encounter with the teachers of Chemistry in secondary schools in the area. In most of the schools observed, teachers do not make effective use of laboratory method in teaching Chemistry even when laboratory provisions have been made.

The population for this study comprises all the teachers of Chemistry in all the thirty-one (31) government owned secondary schools in Enugu Education Zone of Enugu State. The total population of teachers of Chemistry in Enugu Education Zone is 86 (PPSMB Zonal Office Enugu, 2021). The entire population was studied due to the fact that the population size was manageable. This agrees with the view of Asiyai (2016) who stated aptly that when a population is few, the entire population is used in order to give robust information on the phenomenon being studied.

The instrument for data collection was a well-structured questionnaire. The questionnaire is in two sections. The instrument sought data on the extent teachers of Chemistry utilize laboratory method in the implementation of Chemistry curriculum, and the attitude of teachers of Chemistry towards the use of laboratory method in teaching and learning Chemistry. Specialists from Chemistry Education, Measurement and Evaluation, and Curriculum Studies ascertained the validity of the instrument. They examined the appropriateness of the items of the instrument, clarity of language, suitability and its relevance to the purpose of the study. All their observations and corrections were incorporated in the final draft. The ideas, corrections and observation by these specialists helped to shape the formulation of the instruments that were used in data collection for the study. The instrument was then subjected to reliability testing. Cronbach Alpha reliability technique was used to determine the internal consistency of the instrument. The instrument had an overall reliability estimate of 0.76 which indicates that the instrument was reliable for the study.

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Regarding data collection, the researchers with the help of five briefed research assistants visited each of the public secondary schools and administered the instrument to teachers of Chemistry at the instance of the principals' permission and the teachers' consent. The researchers used Mean and standard deviation to answer the research questions. The mean of 2.5 and above were accepted, and below 2.5 were rejected. The researchers also used independent sample of t-test for the hypothesis at 0.05 significant level. The decision rule for the hypothesis holds that when the P-Value is greater than 0.05 (Significant Level), it means that the difference is not significant. When the P-Value is less than 0.05, it is statistically significant ($P > 0.05 =$ Not Significant; $P < 0.05 =$ Significant).

Results

The results of data analysis are presented here. The results are presented in tables according to the specific purposes, and hypothesis that guided the study. The presentation focused solely on the attitude of teachers of Chemistry towards the utilisation of laboratory method in the implementation of Chemistry curriculum. Also, the barriers to effective use of laboratory method in the implementation of Chemistry curriculum in senior secondary schools in Enugu Education zone of Enugu State, Nigeria.

Attitude of Teachers of Chemistry towards the use of Laboratory Method in the Teaching and Learning of Chemistry

The table 1 presents the attitude of teachers of Chemistry towards the use of laboratory method in the teaching and learning of Chemistry in senior secondary schools in Enugu Education zone. The mean and the standard deviation are shown, and decision taken.

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Table 1

Attitude of Chemistry teachers towards the use of laboratory method

S/NO	ITEMS	Mean (\bar{X})	Standard deviation	Decision
1	Laboratory environment frightens teachers of Chemistry	2.51	1.20	Agreed
2	Teachers of Chemistry view Chemistry experiments as a very complex process	3.48	1.18	Agreed
3	Chemistry teachers thought about implementing laboratory method to low extent an inquiry style of teaching	2.54	1.22	Agreed
4	Due to poor foundation in practical, teachers of Chemistry develop laziness to the usage of laboratory method	2.52	1.20	Agreed
5	Teachers of Chemistry see laboratory method as long process and hectic	4.15	1.21	Agreed
	Grand Mean	3.04	1.16	Agreed

Table 1 shows the attitude of teachers of Chemistry towards the use of laboratory method in teaching and learning Chemistry. The grand mean of 3.04 was obtained which is above the bench mark of 2.50 for decision taking. Hence, the attitude of Chemistry teachers towards the use of laboratory method in teaching and learning Chemistry is negative.

Barriers to effective use of Laboratory Method in the Implementation of Chemistry Curriculum

The table 2 shows the barriers to effective use of laboratory method in the implementation of Chemistry curriculum in senior secondary schools in Enugu Education zone. The researchers presented the mean responses of the respondents, and the corresponding standard deviations. Then, they took informed decisions.

Table 2

Barriers to Effective use of Laboratory Method in the Implementation of Chemistry Curriculum

S/NO	ITEMS	Mean (\bar{X})	Standard deviation	Decision
1	Large class size makes it difficult to always use laboratory methods	3.37	1.26	Agreed
2	Lack of laboratory materials for laboratory method is a barrier	3.87	1.19	Agreed

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3	Inadequate number of qualified teachers of Chemistry makes it difficult to use laboratory methods	3.13	1.12	Agreed
4	Defective pre-service teacher training programme which does not equip teachers with the appropriate skills and competencies for laboratory method	3.02	1.23	Agreed
5	The school does not include laboratory work in her end of term examination	2.58	1.12	Agreed
	Grand Mean	2.58	1.12	Agreed

Table 2 shows the barriers to effective use of laboratory method in the implementation of Chemistry curriculum in secondary schools. The grand mean of 2.58 was obtained which is above the bench mark of 2.50 for decision taking. Hence, the listed items impede the effective use of laboratory method in the implementation of Chemistry curriculum in secondary schools.

Hypothesis

The hypothesis looked at the differences in the mean responses of male and female teachers of

Table 3

Differences in the Mean Responses of Male and Female Teachers of Chemistry on the use of Laboratory Method in the Implementation of Senior Secondary School Chemistry Curriculum

Variables	N	\bar{X}	SD	df	T	Sig. (2tailed)
Male	37	23.34	5.89	84	8.12	1.96
Female	49	13.56	4.63			

Result: There was no significant difference in the mean responses of male and female teachers of Chemistry teachers on the use of Laboratory

Chemistry in the utilisation of laboratory method in the implementation of senior secondary school Chemistry curriculum. Independent sample t-test was used to test the hypothesis that guided the study. The summary of the result is displayed in table 3.

H₀: There is no significant difference in the mean responses of male and female teachers of Chemistry on the use of Laboratory method in the implementation of senior secondary school Chemistry curriculum.

method in the implementation of senior secondary school Chemistry curriculum (t=8.12,



df = 93; $p > 0.05$). Therefore, we fail to reject the null hypothesis.

Discussions

Regarding the attitude of teachers of Chemistry towards the use of laboratory method in the implementation of Chemistry curriculum in senior secondary schools in Enugu Education zone of Enugu State, Nigeria, the study found that the teachers have negative attitude towards the utilization of laboratory method for teaching Chemistry. This is in line with the findings of Asiyai (2016), that teachers of Chemistry do not usually find it convenient to make Chemistry practical the centre of their instruction. They usually complain of lack of materials and equipment to carry out Chemistry practical. At the same time, it is possible that some of these materials and equipment may be locked up in the school laboratory store without teachers being aware of their existence. In consistent to this assertion, Odubunni (2011) revealed that a greater degree of participation in the Science laboratory resulted in an improved attitude towards Chemistry learning by students in general; and particularly learning in Chemistry laboratory. Therefore, teachers will only have positive attitude to the laboratory method if they often make use of the laboratory in the teaching of Chemistry. More so, their positive attitude towards the laboratory method will invariably translate to students' interest and motivation; hence, improved academic performance in the subject. This also confirms Vygotsky's theory, which this study hinges on that the child learns through shared problem-solving experiences with someone else, such as teachers, parents, siblings and peers.

On the barriers to effective utilisation of laboratory method for the implementation of

Chemistry curriculum in senior secondary schools in Enugu Education zone of Enugu State, Nigeria, the study revealed the following key challenges: lack of laboratory materials for laboratory method, large class size, and inadequate number of qualified teachers of Chemistry. Supporting the findings of the study, Nzewi (2018) stated that the quality of education of a country largely depends on the quality of teachers. In other words, the quality of education is as good as the quality of teacher. If the quality of teachers is poor, the quality of education will be poor. What this means, therefore is that the quality of teachers will determine the effectiveness of Chemistry curriculum implementation and its enhanced learning outcomes.

The hypothesis revealed that both male and female teachers of Chemistry have the same attitude towards the use of laboratory method in the implementation of senior secondary school Chemistry Curriculum. In addition, they are also faced with the same barriers. This calls for in-service training to help them develop positive attitude towards the laboratory method. Gusau (2018) supports this idea by stating that teachers of Chemistry need to keep abreast with new developments in the system through in-service training.

Conclusion and Recommendations

Drawing from the findings of the study, the researchers conclude that teachers of Chemistry have negative attitude towards the use of laboratory method in the implementation of senior secondary school Chemistry curriculum. Also, that there are various factors that pose hinderance to the utilisation of laboratory method. Among these are inadequate laboratory materials, inadequate number of qualified

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teachers of Chemistry, and large class size. Based on the findings, the researchers made the following recommendations:

1. The school administration should provide all the pitfalls in terms of laboratory materials for effective utilisation of laboratory method in implementing the Chemistry curriculum.
2. Teachers of Chemistry should always be ready for in-service training, in order to develop positive attitude towards the use of laboratory method in the implementation of Chemistry curriculum.
3. The ministry of Education should only send qualified teachers of Chemistry to schools in order to fruitfully cater for the academic needs of students.
4. The school administration should reduce the class size so as to make it easier for the teachers of Chemistry to implement laboratory method in the implementation of Chemistry curriculum.

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