EVALUATION OF LEARNER COMPETENCIES, PERCEPTION, TEACHING METHODS AND RESOURCES IN PRACTICALS ON PERFORMANCE IN CHEMISTRY IN NAROK COUNTY SECONDARY SCHOOLS, KENYA

BY

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DECLARATION

Declaration by the Student

This thesis is my original work and has not been presented for a degree in any other University.

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This thesis has been submitted for examination with our approval as University supervisors.

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DEDICATION

I dedicate this work to my wife, Ruth, our sons Emmanuel Kiprotich and Blasious Kipkirui together with our daughters Abigael Chepkorir and JoyMary Chebet.

ABSTRACT

Practical work plays a key role in the instruction of science and chemistry in particular. Besides assisting students to gain understanding into scientific knowledge, it also helps to acquire a number of scientific skills, namely cognitive, manipulative and motivational. However, the achievement of these goals depends on the way practical work is taught in schools. This study was done to assess the effect of learner competencies in chemistry practicals on performance in chemistry in secondary schools, establish the effect of student perception to chemistry practicals on performance in chemistry, evaluate the influence of teaching methods in chemistry practicals on performance in chemistry and determine the influence of teaching resources in chemistry practicals on performance in chemistry. The study was carried out in Narok County of Kenya. The County was selected because according to report by the Kenya National Examination Council, performance in chemistry has been below average and lack consistency over the years as from 2012 to 2017. A descriptive survey design was used in which data was collected using questionnaire, interview and observation schedule. Document analysis was also used to obtain required information for the study. A sample size of three hundred and seventy-seven respondents were randomly selected from Chemistry teachers and Form three students from 145 public secondary schools in the County. Data was analyzed using descriptive statistics with the aid of Statistical Package for Social Science (SPSS). Analysis of Variance (ANOVA) was used to test the hypotheses. The findings of the study indicated that observation, manipulation, problem solving and computation skills were low which translated to low performance in majority of the schools. Entry characteristics of students had a small impact on performance in chemistry practical. The Analysis of Variance results indicated that science skills which included observation, manipulation, problem solving and computation had positive significant effect on the performance in chemistry ($P < .05$). Student attitude towards teacher and school attributed to the perception towards the subject (practical) hence affecting performance in Chemistry. Student perception in chemistry practical was also found to have positive statistical significant effect on performance in Chemistry ($P<.05$). It was revealed that teaching methods that were mainly adopted were lecture, demonstration and practical that lacked sufficient supervision. This affected significantly performance in Chemistry. Majority of laboratories were not sufficiently equipped with apparatus and reagents and were inadequate to accommodate large classes. Therefore, teaching resources significantly affected the performance in chemistry. The study concluded that learner competencies, attitude, teaching methods and resources had significant effect on the performance in chemistry. It was recommended that there is need to adopt new instructional methods like computer based learning, cooperative learning and guided inquiry laboratory methods to enable students develop competencies essential for handling chemistry practical. School laboratories should be well equipped with reagents and apparatus required for experimental practices.

ABBREVIATIONS

ANOVA:	Analysis Of Variance
CAT:	Chemistry Achievement Test
CDC:	Curriculum Development Council
CPAT:	Chemistry Practical Achievement Test
CPT:	Chemistry Performance Test
CTCOC:	Chemistry Teachers Competency Observation Checklist
IJCDSE:	International Journal for Cross-Disciplinary Subjects in Education
INSET:	In-Service Education and Training
KCSE:	Kenya Certificate of Secondary Education
KLB:	Kenya Literature Bureau
KNEC:	Kenya National Examination Council
MoEST:	Ministry of Education Science and Technology
NAYS:	Kenya National Adolescents and Youth Survey
NCPD:	National Council for Population and Development
PCKLS:	Pedagogical Content Knowledge Guided Lesson Study
PICLEQ:	Patterns of Interaction in Chemistry Laboratory Environment Questionnaire
PPMC:	Pearson Product Moment Correlation
RIP:	Researcher’s Instructional Packages
SBA:	Student Based Assessment
SMASSE:	Strengthening of Mathematics and Science in Secondary Education
SPSTA:	Science Process Skills Teaching Approach
SPSTS:	Science Process Skills Teaching Strategy
SSI:	Senior Secondary I
SSII:	Senior Secondary II
TCQ:	Teachers Competence Questionnaire

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To all God bless.

CHAPTER ONE

INTRODUCTION OF THE STUDY

1.1 Introduction

This chapter presents the background of the study, the statement of the problem, and the purpose of the study. It also presents research objectives, research questions, justification, significance, assumptions, scope and limitations of the study, theoretical framework, and definition of operational terms and summary of the study.

1.2 Background of the Study

The improvement of an exceedingly competitive and integrated economy, innovative advancements, and a developing information base continue to have a significant effect on people’s lives. Like other science electives Chemistry, gives a stage for creating logical proficiency and for building fundamental logical information and aptitudes for deep rooted learning in science and innovation in arrange to meet the challenges postured by these advancements Curriculum Development Council(CDC,2007).

Through the learning of chemistry, it is conceivable to procure significant conceptual and procedural information. Moreover, it makes a difference to create understanding and appreciation of improvements in building, pharmaceutical and other related logical and mechanical areas. In addition, concurring to CDC (2007), learning around the contributions, issues and problems related to advancements in chemistry will offer assistance to learners create an understanding of the relationship between science, innovation, society and the environment.

Chemistry involves use of hands-on activities which enhances development of various skills. A research facility may be a school building prepared with offices, materials and device which students’ utilize, in carrying out examinations (Achimugu, 2012).

Agreeing to Odum, (2013), Chemistry Viable exercises are usually done in a research facility utilizing pieces of device and chemical reagents.

The challenges in the Kenyan education system today are the use of teaching methods which are not adequate e.g lecture, unsupervised discussion, assignments method among others used by teachers of science especially Chemistry in instructional presentations. They have concentrated on teacher - centered methods to accomplish their classroom objectives. Therefore, there is need to assess the performance at every stage to ensure consistent acquisition of both skills and knowledge as teachers prepare the learners for a competitive world of science and technology (Majali, 2010).

Kenya National Examinations Council (KNEC) (2013) reported that, while the number of students taking chemistry in secondary schools has been high, their performance in practical examination is wanting. This is because practical examination determines the grade to which a student is to be awarded. This report suggests that students are unable to skillfully manipulate the apparatus, make accurate observations and also fail to make accurate records to be used to make scientific conclusions. The report indicated that the weakness shown by the students was because serious exposure to practical work is lacking (KNEC, *ibid*).

Chemistry teaching should be approached by use of investigatory methods. Experiments ought to be performed and results be carefully analyzed to promote student understanding of concepts (KNEC, 2007). Practical approach of instruction is a requirement for all teachers and therefore students should be permitted to experiment and develop imaginative thinking skills required in the education system (KNEC, 2009). Generally, performance in chemistry as a science subject has been below average over the years as revealed by the KNEC results in the Table 1.1

Table 1.1: Chemistry KCSE performance nationally (KNEC, 2009 to 2013).

Year	Paper	Candidature	Maximum mark	Mean score	Percentage score
2009	Theory		160	27.42	17.14
	Practical		40	10.86	27.15
	Overall	329,730	200	38.28	21.14
2010	Theory		160	34.97	21.86
	Practical		40	14.87	37.18
	Overall	347,364	200	49.84	27.98
2011	Theory		160	35.42	22.14
	Practical		40	11.91	29.78
	Overall	403,070	200	47.33	25.19
2012	Theory		160	39.54	24.71
	Practical		40	16.34	40.85
	Overall	427,386	200	55.88	31.17
2013	Theory		160	34.99	21.87
	Practical		40	14.67	36.68
	Overall	439,847	200	49.66	27.79

Source: (KNEC, 2013)

The table shows that in the year 2009, a total of three hundred and twenty-nine thousand, seven hundred and thirty (329,730) candidates sat for KCSE chemistry examinations and obtained a mean score of 38.28 equivalent to 21.14%. Three hundred and forty-seven thousand, three hundred and sixty-four (347,364) candidates sat for KCSE chemistry examinations in the year 2010 and obtained a mean score of 49.84 equivalent to 27.98% while in 2011, four hundred and three thousand and seventy (403,070) candidates obtained a mean score of 47.33 equivalent to 25.19% and four hundred and twenty-seven thousand, three hundred and eighty-six (427,386) candidates obtained a mean score of 55.88 equivalent to 31.17% in 2012. Four hundred and thirty-seven thousand, eight hundred and forty-seven (437,847) candidates sat for KCSE examinations and obtained a mean score of 49.66 equivalent to 27.79% in 2013. From the above observations, the percentage scores in Chemistry was low and has not been consistent over the years. The table shows that the percentage scores in practical paper have been below forty percent. Practical touches on various areas of chemistry for example, elements, acids bases and indicators, mole concept, relative atomic mass, dilution of concentrated solutions, stoichiometric equations, salts, energy changes of reactions and reaction rates. Therefore, the paper gave a clear picture of the basic understanding of the learner on the subject content. If practical were well performed, it meant that learners understood the subject well and performance in theory could also be high. Practical approach of instruction should start when students are admitted to secondary school. They should be allowed to carry out experiments themselves to enable them make discoveries on their own environment and arouse more interest in the subject (KNEC, 2013).

KCSE performance in Chemistry has been far below average in Narok County as shown in table 1.2 below.

Table 1.2: Chemistry KCSE Performance in Narok County (2012 - 2017)

Year	2012	2013	2014	2015	2016	2017
Percentage score	23.192	23.050	23.125	32.392	21.116	19.300
Mean Score	2.783	2.766	2.775	3.887	2.534	2.316

From the mean scores, it can be concluded that performance in Chemistry in the County is poor and inconsistent. The percentage scores are below twenty-four percent except in the year 2015 where the percentage score was at 32%. From research conducted by Kenya National Adolescents and Youth Survey, (2015), it was found that the County long delayed in the provision of quality education and is evident from the results in table 1.2 above. The study is necessitated to find the reasons behind the trends in performance in chemistry practical. The paper gives the general view of the extent to which learners understand the entire content. In the present study, the skills to be studied are manipulation, observation, reading, recording, computation and interpretation. They have been selected since they are crucial when handling chemistry practical examination.

This study was conducted to evaluate the effect of learner competencies used when performing chemistry practicals on performance in chemistry, how student perception to chemistry practical affected performance in chemistry, how teaching methods in chemistry practicals influenced performance in chemistry and determine the influence of teaching resources in chemistry practicals on performance in chemistry.

1.3 Statement of the Problem

Poor performance in chemistry as a core subject in the Kenyan secondary school education curriculum has continued to be a major concern to the government and education custodians. Inadequate achievements on the other hand hinder the learners from venturing into competitive careers, for example, medicine, pharmacy and engineering. The government's has been committed to reverse the trend by putting in place different interventions aimed at manpower development. Ndirangu (2000), reports that there has been an outcry as a result of declining performance in science subjects in secondary schools in Kenya. In Narok County, the performance in chemistry has been below average and inconsistent over the years. According to

NAYS (2015), the County lags behind in the provision of quality education. Factors attributed to poor performance include negative attitude of learners, teaching methodologies, inadequate teaching resources and low level of learner competence. Despite this, it is of no degree that they are responsible for such a negative trend in chemistry performance in Narok County. This study sought to evaluate learner competencies, perception, teaching methods and resources in practicals on performance in chemistry in secondary schools in Narok County.

1.4 Purpose of the Study

The study sought to evaluate the effect of learner competencies, perception, teaching methods and resources on performance in chemistry in Narok County secondary schools.

1.5 Objectives of the Study

The study was guided by two sets of objectives; the main objective and subsidiary objectives

1.5.1 Main Objective

The overall objective was to evaluate the effect of learner competencies, perception, teaching methods and resources in chemistry practical on performance in chemistry in secondary schools in Narok County.

1.5.2 Specific Objectives

1. To evaluate the effect of observation, manipulation and computation competencies in chemistry practicals on performance in chemistry.

2. To establish the effect of student perception to chemistry practicals on performance in chemistry in secondary schools.

3. To evaluate the influence of teaching methods in chemistry practicals on performance in chemistry in secondary schools.

4. To determine the influence of teaching resources in chemistry practicals on performance in chemistry in secondary schools.

1.6 Research Hypotheses

The study research hypotheses are;

$H_0$1: There is no significant effect of observation, manipulation and computation competencies in chemistry practicals on performance in chemistry.

$H_0$2: There is no significant effect of student perception to chemistry practicals on performance in chemistry.

$H_0$3: There is no significant influence of teaching methods in chemistry practicals on performance in chemistry.

$H_0$4: There is no significant influence of teaching resources in chemistry practicals on performance in chemistry.

1.7 Justification of study

Chemistry has been identified as a very important pre-requisite science subject for the entrance to science oriented courses such as pharmacy, medicine and engineering. Therefore, students are assisted to manage the encounters presented by the evolving needs of modern work place and overcome the growing unemployment and marginalization in Kenya. Within this context therefore, the County of study experiences dismal performance in chemistry, a compulsory science course essential for major careers. This has a far reaching implication on the preparation of students who are science oriented. The study was carried out to determine the reality of what happens in the secondary school instructional presentations which is translated to either good or poor outcomes in summative evaluation.

Chemistry practical has been selected for the study since it gave the learner an opportunity to develop and apply several skills for example, manipulation, observation, measurement, recording, computation and interpretation which are essential for industry. The experiments touches on various areas of chemistry for example, elements, acids bases and indicators, mole concept, relative atomic mass, dilution of concentrated solutions, and stoichiometric equations, salts, energy changes of reactions and reaction rates. Therefore, the experiments gave a clear picture of the basic understanding of the student on theoretical concepts of the subject. The study was carried out in Narok County of Kenya since performance in Chemistry was dismal and according to research by NAYS (2015), it was reported that the County lagged in the provision of quality education. It therefore necessitated further investigation to ascertain the reasons for poor outcomes in summative evaluation. Also no related study has been carried out among its secondary schools on chemistry practical and performance. There remained a gap that needed to be filled to determine what affected students' activities despite government's involvement in capacity building of science teachers in secondary schools.

1.8 Significance of the Study

The study is expected to benefit several stakeholders in education. These include; Ministry of Education Science and Technology, donors, parents, County government, teachers, students and researchers in the following ways:

Assist the government put more resources for manpower development in the field of chemistry and other sciences leading to increased manpower for industries.

Provide information to the donor communities to support the development of infrastructure such as, equipping of science laboratories in public secondary schools in the County and other marginalized areas.

Enable the government to review the curriculum on effective methods for content delivery for example introduction of ICT assisted instructional approaches for better performance and motivation of learners. This will necessitate review of financial allocations to schools for the purchase of computers, projectors, white boards, fitting of chemistry laboratories with sufficient apparatus and reagents for chemistry practices. Self-assessment of Chemistry teachers' on whether they are effective in the delivery of relevant curriculum as per the course outline.

Provide a substantial report to County government that will enable them make decisions for the support of her institutions and the community of students.

Provide scholars and future researchers with secondary data for future research on related studies.

1.9 Scope and Limitations

1.9.1 Scope of the study

The study was carried out in Narok County of Kenya. It was used to evaluate learner competencies for example observation, manipulation, computation among others and their effect on performance in chemistry. It was carried out among selected Form three students because it's a class where many topics are of practical oriented.

1.9.2 Limitations of the study

Challenges were inevitable and the process of carrying out the study could not be completed without them.

- During data collection process, low response rate of the questionnaire materials was anticipated. Respondents were assured of confidentiality and that the work was purely for academic purposes. The interviewers were advised not to write their names in the report. Several follow- ups were made to ensure that most questionnaire materials were returned.
- Time unavailability due to a busy schedule in the work place. To solve this problem delegation was done and later lesson recovery upon return.
- There was lack of cooperation to provide support services in the Countyfor example, data showing the number of schools and chemistry teachers deployed to ease sampling. Data showing performance trends in the previous years to assist in decision making on the topic of research. This was solved by making requests persistently till required information was provided.
- Insufficient documentation due to lack of computerized systems in the education department posed a challenge but some information was obtained from concerned secondary schools.
- Cost implication for the requirements, resources and travelling expenses. This was solved through financial outsourcing and proper management.

1.10 Theoretical Framework

The research was based on constructivist theory. The theoretical framework was based on the theme that students innovate new ideas or concepts based on existing knowledge. Bruner was one of the founding fathers of constructivist theory. From Bruner's perspective, laboratory method of instruction involves coming up with a problem of investigation. The learner manipulates the laboratory resources available to arrive at desired conclusions (Brunner, 1966). In carrying out this process, the learners utilize their abilities already taught in the classroom to achieve their desired goals through problem solving. Borrowing from Bruner's point of view, the learners should select and transform information, construct hypotheses and make decisions according to their own cognitive abilities. The chemistry teacher should encourage the students to carry out discoveries in science by themselves through experimentation. During the laboratory sessions, the chemistry teacher and the students should engage in active dialogue usually referred to as Socratic learning. This process enables the teacher to translate the information to be learned according to the objectives in a way in which the learner easily understands. Here, the instructional process should be built from known to unknown. This interaction can be promoted by presentations of specific concepts, problems and questions which enhance learning. During instructional activity, the teacher and the students should discuss the results, make observations on practical difficulties and suggest alterations and improvements to meet the desired objectives. Finally, there is need for assessment to ensure that planned activities are being achieved to prepare the learner for summative evaluation.

1.10.1 Education Implication

The general principles of constructivism are applied in the school laboratory when handling titration experiments. Learners acquire knowledge through experience for example, how to set up titration apparatus, preparation and transfer of solutions and performing the actual process to completion. The students make observations at the end point of reaction, determine actual volumes for complete reaction and apply prior knowledge to carry out calculations involving concentration of solutions. These series of activities enable the teacher and the learner to plan, execute and identify the reacting species in chemical reactions suitable for the determination of unknown reactant concentrations

1.12 Conceptual Framework

The success of method of instruction depends on proper management practices in school laboratories. There is need for planning for the desired experiments which involves setting up a problem of investigation, preparation of solutions, time allocation and ensuring availability of apparatus and reagents. The experimental approach of instruction emphasizes on the acquisition of skills for example manipulation, observation, recording, computation and making conclusions. It also enables the development of scientific attitude of learners which include responsibility, curiosity, self confidence, cooperation and genuine interest. The framework below illustrates the summary of effects of proper planning and execution of practical instructions to achieve educational objectives.

Independent variables when properly put in place influence the dependent variables. With effective instructional presentations, the learners improve in the subject score, participate with keen interest and hence improve in practical scores and eventually the overall mean of the learners improve. The school administrators play a key role in the provision of teaching and learning resources for example apparatus and reagents. They also enhance teacher motivation through monetary and non monetary terms. The framework below illustrates the summary.

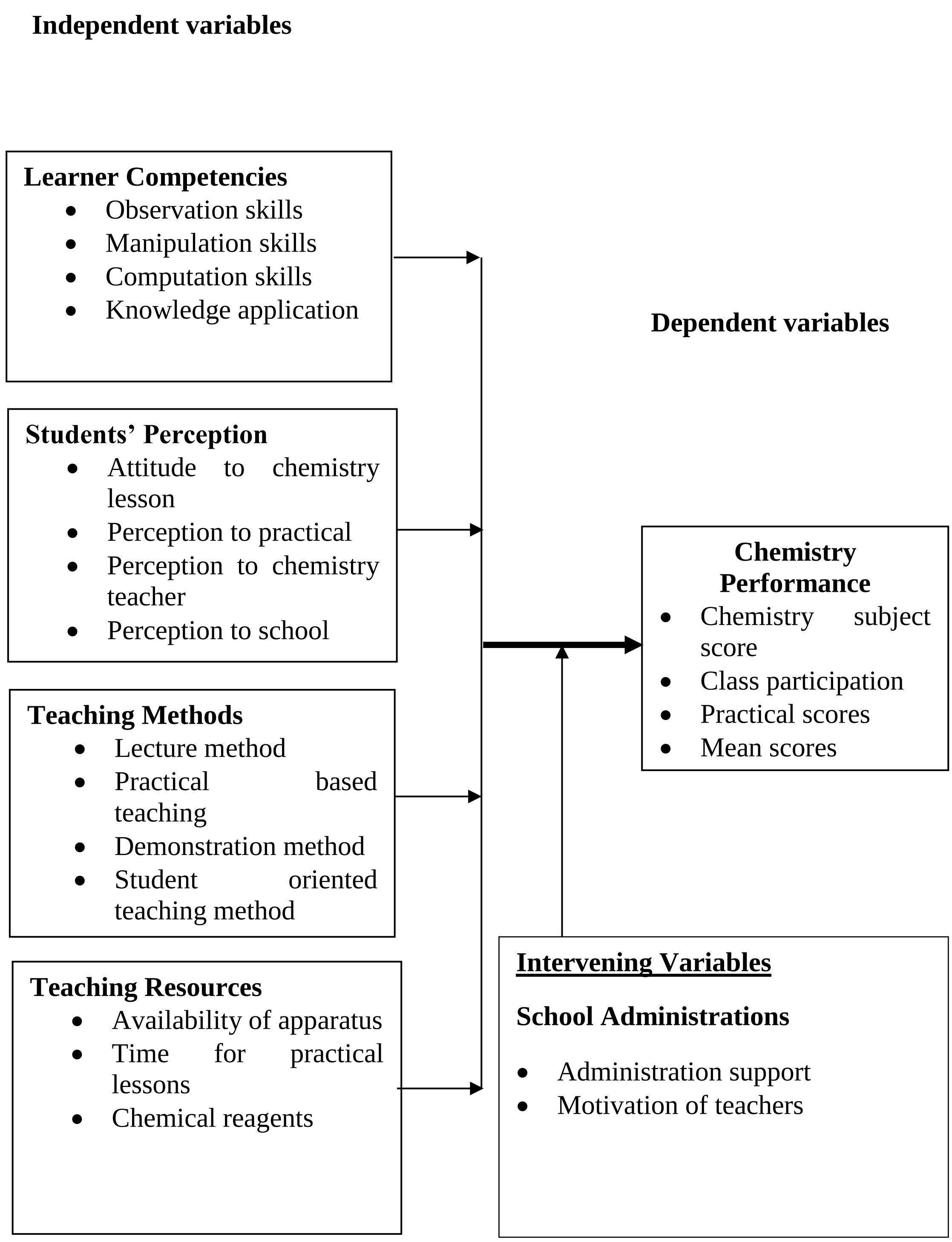

Fig 1.1: Conceptual framework

The success of laboratory activities involves proper planning of laboratory instructions, execution and evaluation of the activities done by the learners as they proceed with the experiments.

1.13 Definition of Operational Terms

Assessment: Evaluation of an activity to determine its achievement or failure. In this study it involves administration of laboratory tasks to the learners.

Chemistry: Science which concerns with the study of structure of substances and their chemical reactions.

Chemistry Education: Teaching/ learning of chemistry subject in secondary schools.

Collaborative learning: The act in which individuals make meanings through interactions with each other and with the environment.

Competencies: Skills learned through experimental interactions for example, manipulation, observation, computation.

Curriculum: Experiences that have been planned to be covered in a program of education to achieve its objectives.

Down to Earth: Practical

Evaluation: Systematic determination of merit. Assessment of performance.

Laboratory: Research facility. A building in a school where practicals are carried out. Fitted with services such as gas and water systems, benches and stools, chemicals and apparatus required for its functional purpose.

Learner: One who is learning. A student.

Obscure arrangement: Solution of unknown concentration.

Practical: A wide array of activities or experiences in a school laboratory where students interact with materials to observe and understand the natural world.

Perception: A way in which something is regarded understood or interpreted.

Performance: Accomplishment or results achieved in a particular task.

Resources: Apparatus, reagents, time, manpower.

Standard arrangement: Solution of known concentration

Teacher: Facilitator who provides guidelines and opportunity for learners to handle practical to solve a problem

Teaching method: Process of instruction.

1.14 Chapter Summary

The chapter presents a problem introduction of research which is basically poor Performance in chemistry in Narok County. It provides how the researcher progressed to find out the instructional activities in practicals in connection with the subject performance.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This involves general information about chemistry education which includes; how chemistry practical is done in the laboratory, role of practical in science, teachers as facilitators, role of technicians in practical activities, learner assessment and related literature on works already done in chemistry education.

2.2 Theoretical Review

2.2.1 Cognitive Learning

Cognitive theory is associated with Jean Piaget, a Swiss Psychologist who established the intellectual property of a growing person from youth stage. In the growth of a child, he was able to identify four main stages of a growing person. The stages include sensorimotor stage between 0 to 2 years where the child gains motor control and learns how to interact with the physical world. Preoperational stage is the second stage between 2-7 years the child develops verbal skills. In concrete operational stage which is age between 7 to 12 years the child begins to gain concepts and create relationships. The final stage is 12 to 15 years where most of the form one to form three are, is the formal operational stage where logical reason and systematic arrangement of ideas (Wood, Smith, & Grossniklus, 2001)

Huitt and Hummel, (1998) argued that the child is able to demonstrate logically integrated thought. The child can interact with the environment to a higher degree and can be given practical materials to manipulate. The growth to adulthood through adolescence happens at the formal operation stage and it is the stage where practical chemistry among other practical subjects is done. It was also noted that it is important to use visual aids and models in passing knowledge, provision of opportunity for discussion in social, political and cultural issues and teaching broad concepts rather than facts and contextual meaningful and relevant. This implies that practical concepts in chemistry are crucial in the knowledge gain and developing the formal operation stage in the child to adult stage.

Bandura (1977) also came up with the social cognitive theory version of cognitive theory which puts emphasis on social form of education and was the key to evolution to social learning theory. The social learning theory emphasized on observing and interacting with other people (Donier, Wolters, & Benson, 2014). However, this disagrees with the chemistry practical design since the students interact with the real physical instruments.

2.2.2 Experiential Learning Theory

John Dewey was a strong believer of Charles Darwin's theory of natural section and adaptation to naturalistic approach. Dewey desired that learners should be able to acquire knowledge by the experimental design. Dewey became the stepping stone to experiential learning theory. According to Herbert and Humphreys (1998) the child's decision is based on some of one's own experience. This emphasized the practical acquisition of knowledge through building, cooking and sewing in school.

Baker, Jensen and Kolb (2002) notes; experiential learning theory is an all-inclusive model of learning process and multi-linear model of adult development, and represents a learning model which simplifies complex experiences within a single framework. The learning model contains two distinct models which are concrete experience (apprehension) and abstract conceptualization (comprehension). The two models of transforming the experience include reflective observation (intension) and active experimentation (extension). Reflective observation is where the learner uses pieces of their thoughts together to create abstract concepts while the active experimentation uses experiment models to obtain the intellectual knowledge. The application of experiential learning theory includes practical, field course, mentor-based internship, group discussion raising questions and getting feedback (Millenbah, Campa & Winterstein, 2000).

Chemistry titration is designed to apply Dewey's experiential learning theory. This is the branch of active experimentation. The learner is said to benefit in innovation, conceptualization, hypothesizing and improve grasps of ideas. The theory can also be used in social science through role playing and reflective thinking.

2.2.3 Bloom's Taxonomy Theory

The hypothesis designer is Benjamin Bloom. The hypothesis has been beneath advancement but initially Bloom's thought was to advance higher shapes of considering instruction (Forehand, 2005). Taxonomy comes from the term classification and with level the student should climb to a higher level of knowledge. The original version of the theory was given by the lowest level containing knowledge, comprehension and application. The higher levels are analysis, synthesis and evaluation. Thus scientific categorization is the pecking order course of action of levels show where an understudy can secure information and judgment skills.

There has been change of terminology in the new version of Bloom's taxonomy where from lowest level in order starts with retention, consideration, application and the higher level as analyzing, evaluating and creating (Anderson & Krathwohl, 2001). The process can be depicted as part of chemistry titration process and adopted in the learning model of experimental research.

The design of the chemistry practical is to follow Bloom's Taxonomy where Form one is remembering, Form two understanding, Form three should enable application and analysis of chemistry concepts and as students' transit to Form four they should be able to evaluate and create concepts ending the taxonomy. The study would investigate the major areas of review to ensure full transition and performance in chemistry by looking at specific factors that contribute to overall well-being of the student.

2.3 Role of Chemistry Education

Chemistry education is the instruction of chemistry in all schools, colleges and universities. Points in chemistry instruction might incorporate, understanding how understudies learn it (chemistry), how best to instruct it, and how to move forward learning results by changing instructing strategies and fitting of chemistry mentors, inside numerous modes for example classroom addresses, shows, and research facility exercises. There is a constant need to update the skills of teachers engaged in teaching chemistry, and so chemistry education speaks to this need(Coppola, 2007).

2.3.1 The Laboratory in Science Teaching

Laboratory experiences have been assumed to promote science education goals which include enhancement of students 'understanding of concepts in science, development of practical skills, problem solving abilities, interest and motivation of learners. Presently at the start of the 21st century it looks as in case the issue with respect to learning in and from the science research facility and the research facility within the setting of instructing and learning chemistry is still important with respect to inquire about issues as well as advancement and usage issues (Hofstein, 2004).

Hofstein (2004) found that laboratory activities have long had a distinctive and central role in the science curriculum and science educators have suggested that many benefits accrue from engaging students in science laboratory activities. Inquiry-type research facilities have the potential to create students' capacities and aptitudes such as: shaping speculations, posturing experimentally situated questions, planning and conducting logical examinations, defining and reexamining logical clarifications, communicating and protecting logical contentions.

Analysts have found science research facilities to be central to the instructing of science in secondary schools. They have been found to be the scientists` workshops where down to earth exercises are conducted to improve important learning of science concepts and hypotheses. They have too been found to be an essential vehicle for advancing formal thinking abilities and students` understanding, subsequently upgrading craved learning results in learners (Adeyemi, 2008). Significant learning is conceivable within the research facility in case the students are given openings to control hardware and materials in an environment appropriate to build their capacity in related science abstracts. In expansion, it was claimed that in general, research had no prove that such openings were provided in school science (Hofstien, 2003).

Chemistry is basically a research facility action situated subject. No course in chemistry can be considered as total without students having to demonstrate their abilities. Research facility movement, here, is utilized to depict the viable exercises which students embrace utilizing chemicals and hardware in a chemistry research facility. The initial reasons for the advancement of research facility work in chemistry education lie within the need to create gifted professionals for industry and exceedingly competent specialists to inquire about research facilities (Belay, 2012).

The science research facility is central in the attempt to create variation of the learning environment in which students acquire basic understanding of logical concepts, science aptitudes, and attitudes towards science. The science research facility, a unique learning environment, may be a setting in which learners can work agreeably in little bunches to explore logical wonders (Hofstein, 2003). He moreover proposed that research facility exercises have the potential to upgrade useful social connections as well as positive states of mind and cognitive development. The social environment in a school research facility is as a rule less formal than in a routine classroom; in this way, the research facility offers openings for profitable, agreeable intelligence among students and the instructor that have the potential to advance positive learning environment. The learning environment depends markedly on the nature of the activities conducted in the lab, the expectations of the teacher (and the students), and the nature of assessment.

Tunde, Oke and Alam (2010) reported that when students are rarely exposed to practical work it resulted to poor communication and observational skills. The absence of the skills gave rise to students' poor performance in chemistry especially in volumetric analysis. This was seen in the study where students were unable to make observations and communicate their findings in chemistry practical because they were exposed to laboratory activities occasionally.

2.3.2 Role of Practicals in Science

Chemistry experiments are accepted to assist students in understanding hypotheses and chemical standards which are troublesome or theoretical. In addition, they offer many openings to students which include safe dealing with chemicals, interaction with instruments and apparatus to develop experience, conceptualization of chemistry subject content, development of competencies essential in solving problems, utilizing opportunities to carry out exploration in chemistry and learning to do assessment and risk management in areas related to chemicals (Emmanuel, 2012).

There are two extreme thoughts regarding the importance of Chemistry laboratory experiments; traditional approaches, according to this approach, little opportunity is given to the student initiatives, all the laboratory procedures are carefully listed in the provided manual, and frequently the student is simply asked to fill in a well-planned report template. At the end of a laboratory session, students have no real opportunity of understanding or learning the process of doing Chemistry (Emmanuel, 2012).

The second one is that a student is given an opportunity to engage in deep learning. This would provide an opportunity to identify the main objectives, plan and execute. Identify the conceptual and practical difficulties encountered, record and discuss the results and observations and suggest practical alterations and improvements (ibid).

Science teachers use practical work to link and scaffold scientific concepts with ‘real world’ situations, providing relevance, which assists students’ understanding of the difficult subject matter. This is especially important with the less tangible subjects of physics and chemistry, which students find ‘harder’ (Anne, 2011).

For centuries, chemistry teachers accept that practical chemistry is vital in chemistry educating and learning forms. Particularly, Achimugu (2012) detailed that the significance of chemistry practical is as mentioned below:

It helps students develop science process skills such as observing, classifying, predicting, measuring, drawing, recording data, hypothesizing, among the many.

It promotes the development of scientific attitudes such as objectivity, honesty, curiosity, patience, open-mindedness, among others. It helps students to understand and appreciate the spirit and methods of science such as problem solving, analytic minds and methods of science. It is used to reinforce theory class and hence encourages the spirit of experimentation. It arouses and maintains interest and curiosity in chemistry. It helps students to develop manipulative skills and proficiency in writing reports. It enhances students' better understanding of concepts, principles which contribute to students' achievements in chemistry. It encourages active participation and discourages rote memorization and inattentiveness of students in class. Enables students to carry out fundamental and applied research in chemistry at all levels of education and helps in the verification of theoretical concepts in chemistry.

When students are furnished with adequate information and abilities related to experimental activities, instructors are empowered to dynamically present manuals or worksheets for practices. These supply opportunities to students understand and appreciate the method of science by themselves. In such inquiry-based tests, they have to plan all or portion of the exploratory strategy, choose on what information to record, analyze and translate the information. Since they are in charge of their own learning, students will appear more enthusiastic and work will be done with responsibility enabling them pick up essential science abilities (CDC, 2007).

The Figure 2.1 below presents the summary of how practical work support science through skills development, experiential learning and providing different ways in which students gain chemistry knowledge.

Skills development such as -Planning -Manipulation of equipment -Observation -Analysis -Evaluation.	Development of personal learning and thinking skills.	Experiential learning -Test out own ideas -Test out theories -Develop problem solving strategies -Develop teamwork -Develop student self esteem.
	Role of practical science	
Independent learning -Students work at their own pace -Build students confidence -Students work at their own level -Supports differentiation by outcome and questioning.		Learning in different ways -working in teams -working as individuals -Manipulating materials and objects -Observing using all senses -Informed dialogue with peers and teachers.

Fig 2.1: How practical work supports science, a framework for practical science in schools (Woodley, 2009)

2.3.3 Volumetric Analysis (Titration Experiments)

Volumetric analysis is a method of quantitative analysis using measurement of volumes. A solution of known concentration is added gradually to another solution of unknown concentration until the reaction between the two solutions is complete. The point at which the reaction is complete is called the end point and is determined by a change in colour of an indicator (KLB, 1988). The concentration of one of the reactants is known but that of the other is unknown. Once the volume of each of the reactants for complete the reaction is known, the concentration of the unknown reactant can be calculated (Muchiri & Maina, 2005).

2.3.4 Titration Apparatus Set-up

The figure 2.2 below shows apparatus set-up for titration experiments in chemistry laboratories. It is used to determine concentrations of unknown reactants in chemical reactions. The set up requires that students be knowledgeable in manipulation and observation skills and be able to communicate findings through proper computation of data obtained.

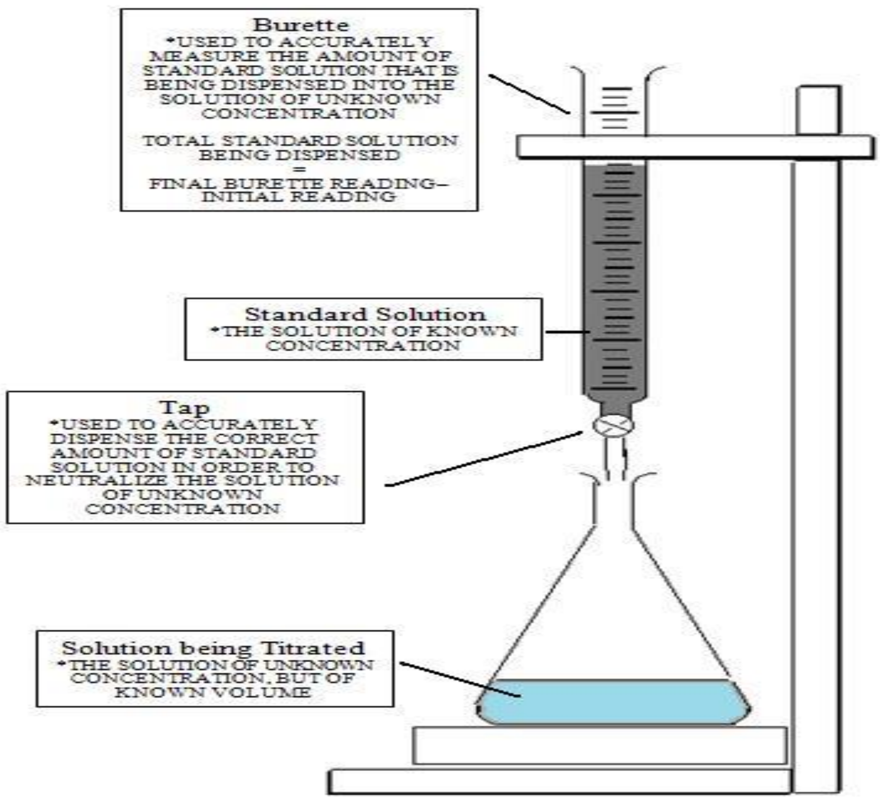

Fig 2.2: Titration Setup

2.3.5 Acid-Base Titration

Within the chemistry lab, at times it is essential to tentatively decide the concentration of an acid arrangement or a base arrangement. A strategy for making this kind of assurance is called an acid-base titration. In this strategy, an arrangement of known concentration, called the standard arrangement, is slowly included to another arrangement of measured volume to which a suitable pointer has been included to decide the conclusion point of response or neutralization point (KLB, 1988). Amid the method, the standard arrangement is run into a settled volume of the analyte arrangement until the response is total (KLB, 2007). On the off chance that the arrangement of obscure concentration is acidic, a standard base arrangement is included to the corrosive arrangement until it is neutralized. In case the arrangement of obscure concentration is fundamental, a standard corrosive arrangement is included to the base arrangement until it is neutralized.

When carrying out an acid-base titration involving strong acids and strong bases phenolphthalein and methyl orange indicators are commonly used because they change colour sharply once the end point is reached (Muchiri & Maina, 2005). A sudden change in colour of the indicator signals that neutralization has occurred. At this point, the number of hydroxonium ions from the acid is equal to the number of hydroxide ions from the base. The point at which this occurs is called the end point of the titration. At the end point the volume of the unknown solution is carefully determined. The concentration of the standard solution is known and the starting volume that one began with. The following steps are used to calculate the unknown concentration:

1. Compose the balanced equation for the response. From the coefficients decide how many moles of corrosive respond with 1 mole of base (and vice versa). Utilize the coefficients to make a mole proportion.

2. If the mole ratio is 1:1, the following relationship can be used to calculate the unknown concentration:

Ma x Va = Mb x Vb, where, Ma- moles of acid, Va-volume of acid, Mb-moles of base and Vb- volume of base.

3. If the mole ratio is not 1:1, the calculation of the unknown molarity is slightly more complicated. For example, if 2 moles of standard acid solution is needed to neutralize 1 mole of unknown concentration, the following relationship exists:

Ma x Va = 2(Mb x Vb)

In this experiment, you will determine the molarity of an unknown solution of NaOH by titrating it with a standard solution of HCl. The equation for the reaction is $NaOH_{(aq)} + HCl_{(aq)}$ ---->$NaCl_{(aq)} + H_2O_{(l)}$

2.3.6 The Importance of Volumetric Analysis

Volumetric investigation is utilized in high school and college chemistry research facilities to decide concentrations of obscure substances. Medical research facilities and clinics utilize robotized titration gear for essentially the same reason. The method has found plentiful utilize in explanatory research facilities and businesses, for occasion fabricate of drugs, fine chemicals, petrochemicals, refreshments and nourishment handling advantage immensely by the application of this handle. For illustration, in biodiesel industry, it is utilized to decide the acidity of a test of vegetable oil (Tunde, Oke and Alam 2010). During the study it was found that students had not well developed scientific skills to help them solve practical problems, for example in handing volumetric analysis which form an important part in chemistry practical in schools.

2.3.7 Role of Technicians in Chemistry Practical

Science specialists too offer learner instructors an opportunity to end up more familiar with viable work earlier to educating their assigned lessons. This introduction to practical eases the learner teachers' concern with practical work, permitting them to concentrate on creating their academic abilities. They are adaptable to oversee workloads, than instructors, as they are not kept by lesson timings, to supply preparing in practical work. Science professionals can offer assistance and training to all science instructors new with pieces of practical work contained within the science educational programs and in numerous cases prepared to supply this benefit. Understanding how school science experiments work, their health and safety considerations is the main function of their role and so technicians are in an excellent position to offer training for less experienced teachers and consequently their students. Much more should be made of the skills that this body of people has to offer (Ann, 2011).

2.3.8 Social Interaction in the Laboratory

Science instructors dynamically see the school science investigate office as a uncommon learning environment in which students can work pleasingly in small bunches to investigate scientific events and associations. The investigation offers uncommon openings for learners and their educators to lock in collaborative task and to function as a classroom community of analysts. Such experiences offer students openings to consider how to disentangle issues and make their understanding.

Through collaboration, they can as well come to urge the nature of an expertise scientific community (Hofstein, 2003).

2.3.9 Assessing Learners in the Laboratory

Appraisals of students' execution and understanding related with the science research facility ought to be a necessarily portion of the research facility work of instructors and students. Appraisal instruments should to look at the students' request aptitudes, their discernments of logical request, and related logical concepts and applications distinguished as vital learning results for the examination or the arrangement of examinations. Hofstein (2003) detailed that information assembled in numerous nations have kept on propose that instructors spend expansive parcels of research facility time in administrative capacities, not in requesting and testing thoughts or in educating that challenges students' thoughts, empowering them to consider and test elective speculations and clarifications. More touchy measures of students' understanding of research facility techniques, the speculations and questions they create from the lab encounters, and the viable abilities they display have all as well regularly been dismissed.

Practical work and logical examination are common exercises within the instructing and learning of science subjects. They offer students "hands-on" involvement of exploring ways to reveal their interest, inventiveness and diligence. In logical examinations, instructors can begin by posting an issue and inquire students to plan and propose suitable test methods for understanding it and the plan of the examinations can at that point be examined and if need be, altered. Amid such sessions, instructors watch their' abilities for illustration, how they handle device, estimation, dilutions, performing titration, recording of information, computation and give criticism on how the experiment/investigation can be progressed. Assessment of students' research facility reports can furnish instructors with a great picture of their understanding of chemical concepts and principles included, as well as their ability to handle and interpret data obtained in investigations (CDC, 2007).

During this study it was found that students had low practical skills and therefore affected the way they communicated their findings. They performed practicals with less or no teacher supervision, reports were assessed occasionally making them unable to employ diligently chemistry knowledge in solving problems. This affected their performance negatively.

The council further reported that the general point of examination is to survey candidates' capacity to illustrate their information and understanding in several areas of chemistry and its application to recognizable and new circumstances. School based evaluation in Chemistry is to improve the legitimacy of evaluation by appraisal of students' viable aptitudes. It decreases reliance on the outcomes of public examinations, which may not continuously give the foremost dependable sign of the genuine capacities of candidates. Getting evaluations based on students' actual execution over an amplified period of time and created by those who know them best, their subject instructors, will give a more dependable evaluation of each student. SBA can serve to inspire students by requiring them to participate in significant exercises; and for instructors, it can fortify the educational goals and good instructional practice. It'll give structure and noteworthiness on their daily practices, to be specific surveying their claim students.

Through the ministry of education, the government detailed that the current summative evaluation at the conclusion of each cycle does not degree learners' capacities and so proposed presentation and the reinforcing of school based evaluation in shape of Competence Evaluation Tests (CATs) (MOE, 2013). The current education system is examination oriented and the kind of assessment carried out has little regard to molding good citizens for self-reliance. It is seen as a sieve to determine those who can move to higher education where the limited available space dictates the teaching/ learning process towards examination as opposed to competences applicable to life (CDC, 2007).

2.3.10 Why Assess Practical Skills?

This is because practical work is a fundamental skill for a scientist. It enhances skill development essential in science enterprise. To eliminate memorization, find out the individual student competencies and avoid cheating on tests. It allows the teacher to discover the problems that students face when directly observing how they perform practice tasks. This will aid find solutions and fixes as students prepare for the final grade of the Kenya National Examination Board, where examiners only grade the written report, but do not observe students during the actual practical examinations. In the current study, evaluation was carried out to a small extent by chemistry teachers. Observation, manipulation and computing skills were assessed, although found to be less developed in practice.

2.4 Related Literature

2.4.1 Science Process Skills in School Laboratories

The American Association for the Advancement of Science (AAAS) study incorporated fundamental and integrated process aptitudes in an intervention and the result uncovered that improved science handle abilities in science lessons, raised the level of execution in science by boys. The discoveries of an examination carried out on the impact of educating science with emphasis on abilities for advancing execution in science showed a positive result (Abungu, 2014). Abimola (1994) detailed that, research facility exercises upgrade the instructing and learning of logical aptitudes, concepts, attitudes, cognitive capacities and understanding the nature of science. Many investigations have been conducted to examine the effectiveness of research facility work in science instruction in the fulfillment of cognitive, affective and practical objectives (Hofstein & Mamlok, 2007).

Science teachers see research facility exercises as central within the science educational programs practices and have proposed that numerous benefits collect from engaging students in science research facility exercises. In Kenya, the secondary school curriculum has had a long history of practical based approach to teaching science and the most recent initiative is the 8.4.4 curriculum in which science syllabus places special attention on practicals. The need for students to engage in science process skills is clearly expressed within the goals of instructing Chemistry in secondary schools and the government arrangement on SMASSE, programs. The instructional strategies embraced in science lessons are intended to advance problem solving exercises, projects and improvisation (Abungu, 2014).

Hofstein and Mamlok (2007) strengthened that important learning is conceivable within the research facility on the off chance that students are given opportunities to control hardware and materials in order to be able to build their knowledge base and related logical concepts.

Science Process Skills Teaching Approach (SPSTA) in secondary schools in Kenya is expected to encourage the procurement of abilities and application of logical information fundamental for the economic take-off within the 21st century. The exercises beneath this system centers on a wide range of aptitudes and processes and confirm to the importance of test work within the secondary schools' science. In case all the secondary schools take up the challenge truly at that point most of the graduates will be prepared with process skills essential for technological advancement of this country (Abungu, 2014). Further, it was observed that, Chemistry in particular, takes up an awfully significant place within the secondary school educational programs because of its applications in lifestyle and the part it plays in student empowerment to create mental and viable abilities. In any case, it was proposed that through hands-on activities in Chemistry students are enabled to develop science aptitudes fundamental for tackling issues. In genuine life circumstances, its chemical information has made strides in the life of mankind within the range of medication, farming, transport and nourishment industry.

2.4.2 Role of the Teacher in the Laboratory

The key part of the educator is to instruct, meaning to encourage learning of target educational programs. Instructing is in this manner personally tied to ideas of learning, and there's a sense that if students don't learn, at that point anything the educator is doing does not merit the name of 'teaching' (Valencic & Vogrinc, 2010). The constructivist view of learning proposes that instructors have to be specialists in proficient problem-solving, who are exceedingly educated around such things as subject information and academic information. The educator organizes the associations between the subject (learner) and the object (learning materials). He guarantees that hardware and materials are legitimately utilized by the learner to attain the anticipated destinations. All these point to the truth that the instructor could be an exceptionally critical calculate when the learners fizzled to show the anticipated dominance in a science subject like chemistry (Odum, 2013).

Studies depict non-specialist instructors deliver more repetition learning, ‘recipe style’ practical work and less inventiveness in students’ science lessons. Fault has been ascribed to science instructors being insufficiently sure with the specialized capacity to securely convey practical work amid science lessons. Further, non-specialist instructors charged with physical science subjects show a more noteworthy hesitance to utilize down to earth work (Anne, 2011).

Research on components that influence students’ execution in viable chemistry recorded among others teacher’s state of mind to chemistry research facility work. Practical activities require appropriate execution amid science lessons to supply relevance for students and enhance understanding of unique, logical concepts. In any case, writing appears, schools with deficiently supplies of master science instructors influence student’s ‘choice and performance’ at pre-university level and brings down their chance of fulfillment (Odum, 2013). According to the study students’ achievement depended to a greater extend on the teacher’s method of instruction in handling chemistry practical. It was found that they transferred their attitude towards the students. Those who had negative attitude towards the subject made their students develop negative attitude and vice versa.

2.4.3 Challenges in Instructional Presentations

Research study revealed that time constraint is one of the major factors responsible for the poor performance. If the syllabus is not covered that means science practical are not conducted and this make learners discouraged and unready for assessment. The number of periods given to chemistry per week and the time apportioned for each lesson is more often not sufficient for viable learning since the instructor cannot conduct any important practical inside the time restrain (Edomwonyi-Otu, 2011).

Negative effect on students' execution in chemistry is research facility insufficiency, which is an environmental issue. From investigate it was realised that few students truly felt they would have performed way better in case they had been instructed periodically in practicals in great time. It is contended that students tend to get it and review what they see more than what they listen to as a result of utilizing research facilities within the instructing of sciences, but most schools need utilitarian research facilities (ibid).

Examination malpractice has done so much harm than good to students' performance not only in chemistry but generally in sciences and this is thought to be caused by learners' unpreparedness to assessment (Edomwonyi-Otu, 2011).

Students frequently encounter a number of troubles when they are first introduced to titrations, from dealing with the hardware accurately to the failure to take after instructions. Some schools need sufficient great quality equipment, constraining students to work in huge bunches. Others fight with defective burettes, driving to insignificant results full of mistakes exchanging excess volume of reagent, failure to watch colour alter to check conclusion of response (Waren, 2015).

2.4.4 Resource Availability and Assessment

Laboratories for teaching and learning science are important but they should be equipped with the necessary apparatus and reagents required for chemical reactions. The laboratory cannot be effective unless a laboratory technician is present whose role is to ensure proper management of its activities and assist the teacher with preparations for the practical lessons. In secondary schools with trained laboratory technicians, preparation load on the teacher is minimal and hence spends most of the time in actual lesson planning. Where there is no trained laboratory technician, the teacher doubles as a technician and an instructor. This decreases the teacher's effectiveness in content delivery (Orando, 2009). Suitable research facility exercises can be viable in advancing cognitive abilities, metacognitive aptitudes, practical abilities, attitude and interest towards chemistry, learning chemistry, and practical work within the setting of chemistry learning. In expansion, it is evident that giving students viable learning encounters has the potential to differ the classroom learning environment and in this way to improve students' inspiration to ponder science (chemistry) (Hofstein, 2004).

Research has been carried out in various areas of chemistry and performance. Mutuku (2014) reported that performance of students in chemistry is attributed to background factors of which poor entry behaviour and teacher and students' factors are major causes of poor performance. It is cited that chemistry teacher's negative perception on their learners' abilities, inadequate instructional resources in teaching and learning and inappropriate learning environment as major causes of repetitive poor performance in chemistry. The study involving the use of learning cycle for student achievement in chemistry was carried out and it showed that meaningful instructional approaches which include, inquiry method, cooperate learning and critical thinking when used significantly affects learning outcomes positively (Opara, 2013).

According to Abungu, (2014) Science Process Skills Teaching Strategy (SPSTS) enhanced instructional process although it is gender biased to boys. He therefore proposed the need for its application in a way that boys and girls have equal opportunities to interact with the instructors, amongst themselves and resources. The students who had an opportunity to carry out guided investigation performed better in chemistry. When students regularly interact with chemistry practical resources, they sharpen their abilities and secure logical aptitudes which affect positively on their accomplishments in chemistry. The study moreover uncovers the need to full equipment of science research facilities in schools to empower students' inclusion in viable related exercises.

2.5 Empirical Literature

Empirical literature is the findings from research through scientific experimentation related to the current study. It provides findings on science competencies, perception, teaching methods and resources on performance in chemistry.

2.5.1 Science Competence and Performance in Chemistry

Lucenario, Yangco, Punzalan and Espinosa (2016) examined the adequacy of Pedagogical Content Knowledge-Guided Lesson study (PCKLS) as an intercession to create PCK competencies among instructors and subsequently improve student accomplishment in terms of conceptual understanding and problem-solving abilities. Utilizing quasi-experimental plan, instructor competencies and student accomplishment within the PCKLS gather and the conventional group were compared. Within the PCKLS gather, the mediation included arranging the lesson by the inquire about group, educating the arranged lesson whereas PCK perceptions were made by the analyst and another instructor from the group, including a input assembly, executing the advancements within the research stage of the lesson study cycle by another educator from the inquire about group, and, at long last, changing lesson plans based on the solidified recommendations for advancement. Examination of information appeared that there was a noteworthy contrast within the science educator competencies of the PCKLS gather instructor respondents compared to those of the customary gather. Too, student respondents appeared to have a critical increase on average scores in terms of conceptual understanding and problem-solving abilities.

Hence, it was concluded that PCKLS was a successful strategy to create the teachers' PCK competencies and student accomplishment in terms of conceptual understanding and issue fathoming. The study prescribes that this intercession be utilized over chemistry subject themes and other sciences such as, Soil and Natural Science, Material science, and Arithmetic.

Vincent-Ruz and Schum (2017) investigated the increasingly important role of science competency beliefs for science learning in girls. It is a requirement to inquire about on how inner and outside variables connected with one another to demotivate girls and youthful women from seeking after science careers. The investigation reveals how girls' competency convictions are a fundamental establishment for science substance learning amid centre school and how these impacts of competency convictions are interceded in and out-of-school components. Two thousand nine hundred students were recruited from 6th and 8th grade students from two distinctive locales within the Joined together States. At two distinctive time focuses, students completed questionnaires requiring them to give their position toward science such as competency convictions in science, readiness to lock in argumentation, and choice inclinations toward discretionary science encounters.

The study too collected a thinking capacity degree, and pre- and post-tests on science substance information. Besides, students detailed on their cognitive behavioural engagement amid a tested science lesson on two isolated events. Different relapse and intervention examinations appear that as boys develop ancient, their readiness to lock in argumentation and to take part in science encounters smothers the part of competency convictions on their learning science substance. By differentiate, as girls developed more seasoned, they appeared to have expanding competency convictions to attain solid substance learning gains. The results demonstrate that despite girls' willingness to participate inscientific argumentation and to take part in science experiences, they probably do not receive enough supporting their environment to access the benefits of these experiences, and hence they have a stronger need to havehigh competency beliefs in order to achieve significant growth in science learning.

Nbina (2012) explored the impact of teacher's competence on students' scholarly execution in senior secondary chemistry. An arbitrary testing procedure was utilized to choose 6 secondary schools out of 10 in Tai Neighbourhood Government Region of Streams State. A test of 200 students, 20 instructors and 6 principals were utilized. An overview plan was embraced for Teachers Competence Questionnaire (TCQ) and Chemistry Achievement Test (CAT) was utilized to accumulate data for study. Three researcher-made tools specifically, School Principal Questionnaire (SPQ), Teacher Competence Questionnaire (TCQ) and Chemistry Achievement Test (CAT) were utilized to accumulate information for the study. Information was dissected utilizing the Pearson Product Moment Correlation (PPMC) and t-test. Outcomes uncovered that there's noteworthy relationship between teachers' competence and students' scholarly execution in chemistry. Chemistry students instructed by qualified instructors performed essentially way better than those instructed by unqualified instructors. Too chemistry students instructed by experienced instructors performed altogether way better than those instructed by unpractised instructors. Suggestions were made on how to raise further advancement of science instructors in Nigeria.

Copriady (2014) explored the commitment of teachers' competency in instructing and learning viable chemistry from the interrelated angles of planning, arranging, executing and assessing experiments in moving forward the quality and benchmarks of educating and learning viable chemistry. Usually an overview employing a survey as the most commonly used instrument to decide the four viewpoints of the previously mentioned competencies. The samples were randomly selected consisting of 234 chemistry teachers in Riau, Indonesia. Data were analysed using multiple regression to assess the contribution of the four components of competency namely, description, performance criteria, range statement and evidence guide to analyse the quality of instructing and learning for practical chemistry. The discoveries appear that the level of competency in all perspectives of planning, arranging, executing and assessing of practical preparing is at the direct level. Strong and vital endeavours should be taken to extend teachers' competency and securing of more advanced research facility materials ought to be done.

Arokoyu and Needom (2019) examined volumetric analysis being a practical aspect of Chemistry and secondary school teachers' competence in Eleme Local Government Area of Rivers State. The study used survey design. A sample size of 144 senior secondary school Chemistry teachers were purposively selected from 64 public and private schools in rural and urban areas. Chemistry Teachers' Competency Observation Checklist (CTCOC) was the instrument for data collection. Three research questions were raised and answered using mean and standard deviation. Two hypotheses were tested at 0.05 level of significance using z-test. Related literature was reviewed. Pearson Product Moment Correlation was used to calculate the reliability coefficient which yielded 0.89. The results obtained after data analyses indicated that qualifications enhanced teachers' competencies and that the Chemistry teachers in urban area were more competent in handling volumetric analysis (quantitative analysis). According to these findings, recommendations were made that teachers should be employed based on qualifications as this would improve the overall standard of education.

Adlim*et al.*, (2013) investigated learning competency based on the Indonesian National Examination centering particularly on chemistry execution and the circumstances of senior high school students and instructors in the country regions of Simeulue Island, Indonesia. The National Examination overall score and chemistry score for students in rural regions were reliably lower than those in urban zones amid 2008–2010. Most of the students in rural schools had difficulty to master chemistry concepts. Their outcomes on laboratory-based questions showed up to demonstrate that the related practical activities were not done as portion of the chemistry courses. Some chemistry themes were not instructed due to deficient time, student weaknesses, inadequately course readings, and other reasons. The issues of low competency of instructors, poverty, low enrolment in schools, and lack of competition among learners in these rural schools showed up to be common among rural settings. The nearby government has prescribed interventions for example; deployment qualified chemistry instructors, fitting of research facilities, and transportation to address variables contrarily affecting student accomplishment. Besides, neighbourhood rural school authorities have to enrol and hold qualified instructors in these confined regions give compelling course books, instructional materials and encourage professional development of chemistry instructors. According to the current study laboratory apparatus and reagents were not adequate for practical activities. Teachers therefore opted to group their students when handling practical activities although the arrangement was affected by inadequate supervision and assessment which negated their internalization of scientific skills necessary for evaluation.

2.5.2 Student's Perception and Performance in Chemistry

Mahdi, (2014) did a study on students' attitude towards Chemistry. Chemistry is one of the establishments of science, innovation and industry. It shapes the essentials of life sciences. The study pointed to examine what made students select or not to select Chemistry and what are the most variables that contribute to the understanding of Chemistry as a subject? Four angles were utilized to assess students' states of mind towards Chemical instruction, discernments toward Chemistry, the concept of chemical information and its understanding, application of chemical information and understanding and career employing a survey method. Respondents showed that students were positive with most articulations to support their education, in spite of the recognition that Chemistry may be a troublesome subject. Furthermore, respondents indicated that Chemistry is an interesting and not a boring subject, which certainly demands more attention to raise its status.

Odutuyi (2012) investigated the relationship between Students' Perception of patterns and students' learning outcomes in secondary school chemistry. Specifically, the study examined the relationship between students' perception of interaction patterns and their performance in Chemistry. It also assessed the relationship between students' perception of interaction patterns and attitude towards the learning of chemistry. The study adopted a survey design. Six hundred and ninety Senior Secondary School Three (SS111) chemistry students in their intact classes from twenty-four purposively selected secondary schools in six Local Government Areas of Ondo State, Nigeria constituted the sample. Two research instruments were used for collection of data, namely; Chemistry Practical Achievement Test (CPAT) and Patterns of Interaction in Chemistry Laboratory Environment Questionnaire (PICLEQ). The coefficient of reliability of CPAT and PICLEQ determined using Cronbach Alpha were 0.84 and 0.76, respectively. The data collected were analyzed using multiple regression analysis.

The findings showed that there was significant relationship between teacher-students' interaction patterns and students' performance. It showed that there was significant relationship between students' perception of students' interaction patterns and their attitude towards chemistry. It was also revealed that student participation was the most favorably perceived dimension in terms of attitude to chemistry. This implied that for students to learn effectively they must participate fully in the learning processes. Based on the findings, it was recommended that teachers should give students plenty of opportunities to contribute and elaborate their own ideas and that he or she genuinely listens to what students say and attempts to consider this from students' perspective. This would enhance the teaching and learning of chemistry as well as making students develop positive attitude towards the subject. This study examined the relationship between teacher-related factors and students' attitude towards Chemistry subject in secondary schools in Kenya. This was related to the findings of the current research that teacher instructional methods applied affected performance of students in one way or the other. Similarly, teacher attitude was transferred to the students.

Chepkorir, Marusoi and Chemutai, (2014) conducted a diligent inquiry in Bureti Area in Kericho County, Kenya which highlighted issues on the educating strategies utilized by chemistry instructors, their accessibility to handle different student needs pertaining to the subject, their utilize of instructional materials in educating, teachers' individual levels of aptitudes and subject mastery in Chemistry and the effects of students' negative behaviour towards Chemistry on teachers' viability. A survey was used for data collection. The target populace comprised Form four students in ten chosen secondary schools in Bureti district.

Stratified irregular sampling procedure was utilized to choose the respondents to provide desired information. Schools were chosen from the taking after categories: Girls' schools, Boys' schools and Co-educational schools. Basic random sampling was utilized to choose the respondents from Form four classes as well as an instructor in each school. In all, one hundred and eighty-nine students and ten instructors filled the surveys. The information collection instruments were surveys based on the Likert scale and report investigation. Information was examined distinctly utilizing recurrence tables, averages and percentages whereas theories were tried utilizing Analysis of Variance.

From the study discoveries, a number of pointers uncovered that there were some variables impacting students' state of mind towards Chemistry, inadequate experience in Chemistry and destitute instructing. It was prescribed that science instructors ought to energize improvement of positive self-concept of capacity among learners. It was proposed that direction and advising in schools ought to be empowered to guarantee positive state of mind towards the subject and full involvement by girls within the subject (Chepkorir, Marusoi and Chemutai,2014)

2.5.3 Teaching Method and Performance in Chemistry

Alade and Ogbo (2014) explored the learning fashion inclinations utilized by students of chemistry in both government and private secondary schools in Lagos city, Nigeria. The result appeared that there was a noteworthy relationship between learning fashion inclinations of students and their execution within the chemistry accomplishment test in both schools. Visual learning fashion was the overwhelming inclination in both school sorts. It was suggested that chemistry instructors ought to utilize an assortment of educating styles to suit the different learning styles for content delivery. An arrangement between educating and learning styles would make strides the educating, learning and execution of students in Chemistry subjects.

Okwiduba and Okigbo (2018) conducted a diligent inquiry on impacts of educating strategies on scholastic execution of students and they demonstrated to be critical. This consider utilized Meta explanatory audit to harmonize investigations conducted in Nigeria from 1990 to 2010 on impact of educating strategy on students' scholastic execution in chemistry. Seven classes of educating strategy were distinguished and they included authority learning (-0.013), Computer Helped Instruction (0.146), Guidelines Materials (0.208), Issue fathoming (0.315), Constructivist/concept mapping (-0.203), games/simulation/animations (0.173), student grouping/cooperative learning (0.218) where issue understanding, student grouping learning, guidelines fabric based learning as well as re-enactment (simulation) contributed emphatically on the scholastic execution.

Uzezi and Zainab (2017) did a study on effectiveness of Guided-Inquiry Laboratory Experiments on senior secondary schools' student academic achievement in volumetric analysis. The diligent destitute execution of students in practical tests in chemistry has been faulted on destitute choice of educating strategies and destitute understanding of fundamental concepts in subjective and quantitative examination. The reason behind the investigation was to examine the impacts of guided-inquiry research facility tests on Senior Secondary School students' scholastic accomplishment in Volumetric Investigation. The plan for the inquiry was a pre-test post-test control gather quasi-experimental plan. The instrument utilized for information collection was Volumetric Examination Accomplishment Test. The statistical tools used for data analysis in the study were means, t-test and Analysis of Covariance. The discoveries appeared that guided-inquiry research facility tests had critical impact on students' scholastic accomplishment in chemistry than the conventional instructing strategy since it propelled the students to better understand chemistry concepts which was reflected in their performance outcomes. The discoveries moreover uncovered that the technique was not gender bias. This appeared that both genders profited essentially from the directions approaches; since it was student-activity situated which made them to participate in rigorous reasoning enabling them build their aptitude. The findings from the study showed that guided-inquiry laboratory experiments have significant effect on students offering chemistry' academic achievement than the traditional teaching method since it motivated the students and this was positively reflected in their chemistry mean achievement scores. The findings also revealed that gender has no significant effect on academic achievement of students exposed to Chemistry through guided-inquiry laboratory experiments. This showed that males and females benefited significantly from the instructional approaches; since it was student-activity oriented which made them engaged in in-depth critical thinking and process skills. The discoveries concurred with the current inquire about where both sex were given break even with chances in scholastic exercises. On the other hand, traditional instructional methods affected students' achievements. This requires the use of innovative techniques like integrated computer technology to enhance students understanding and motivation.

Danili and Reid (2012) investigated on teaching styles to improve performance in Chemistry based on two cognitive factors. The study was centred on the challenges confronting the larger part of Greek pupils' in understanding chemistry concepts and, thus, performing well within the National Examinations. The aim was to explore the problems and to suggest ways in which the situation might be improved. Working with 105 Greek students with mature age of 15 to 16, the first stage of the enquiry affirmed that both working memory space and extent of field reliance were two mental variables influencing execution. This was at least part of the nature of the issue. Within the moment organize, an endeavour was made to investigate how the issues may well be diminished. Modern educating materials were developed to play down any restrictions to learning caused by working memory space and issues related with being field subordinate. The use of the modern materials was compared to the typical educating handle working with 210 Greek students matured at 15 to 16. It was found that there was a significant difference in the average improvement of the experimental group and the control group, in favour of the experimental group. This result was independent of the effect of the teacher, and of the interaction of teaching method and the teacher. It is suggested that approaches to learning must take into account cognitive factors in the learners in the context of information processing understandings of learning. If this is done, learning is much more effective.

Aluko (2008) explored the relative viability of agreeable guidelines procedure on students' execution in secondary chemistry. Two hundred and fifty (250) Chemistry students were purposely sampled from Senior Secondary two (SSII) government schools in Ilesa Range of Osun State, Nigeria. Two investigate tools were utilized: Researcher's Instructional Packages for Problem solving (RIP) and Chemistry Performance Test (CPT) were created, approved and utilized for the consider. The unwavering quality of the (CPT) was decided and found to be 0.62 utilizing the Pearson Product Moment Correlation equation. Three theories were raised and tried utilizing Analysis of Covariance (ANCOVA). The investigation secured a period of six (6) weeks. The test gather (experimental group), which is cooperative instructional strategy gather and a Control bunch, were utilized. The results of the analysis showed that there was a significant difference in the performance of chemistry students exposed to cooperative instructional strategy and conventional teaching method. The cooperative instructional strategy was found to be more effective in enhancing better performance of the learners. Some recommendations were also made.

Ibrahim, Hamza, Bello and Adamu (2018) investigated effects of inquiry and lecture methods of teaching on students' academic achievement and retention ability among N.C.E 1 Chemistry students of Federal College of Education, Zaria. The study was a pre-test, post-test semi test control gather plan. A sample of 256 students was chosen in line with Krejcie and Morgan (1970) test estimate table. A Separation Technique Chemistry Accomplishment Test (STCAT) was utilized for information collection. The STCAT was created and approved by specialists in chemistry instruction. The unwavering quality coefficient of STCAT was found to be r = 0.88. Investigation of information utilizing t-test insights appeared that the test gather which was instructed chemistry utilizing request educating strategies performed essentially superior than the control bunch which was instructed utilizing the conventional address strategy (lecture). Other discoveries of the investigation were that inquiry strategy of instruction was gender-sensitive which it improved maintenance. The study suggested, among others, that chemistry instructors ought to be energized to use inquiry strategy within the educating of chemistry.

Omwirhiren, (2015) sought to determine how academic achievement and retention in chemistry is enhanced using the two instructional methods among SSII students and ascertained the differential performance of male and female students in chemistry with a view of improving student performance in chemistry. The study adopted a non-equivalent pre-test, post-test control quasi-experimental design. A total of one hundred and eighteen senior secondary school II students in intact classes were chosen from three schools in Gboko Local Government Area of Benue State using purposive random sampling. The ages of the students ranged between 16-17 years. Data were collected using a 30- item multiple choice Chemistry Achievement Test (CAT), in organic chemistry. Students were assigned to a treatment and a control group. Three hypotheses were generated and tested at 0.05 significance level. The information gotten was examined utilizing clear measurements, t-test, Spearman's relationship coefficient and examination of change (ANOVA). There was critical distinction in students' execution when discussion and lecture techniques were utilized to instruct chemistry ($F_{cal} = 4.65 > F_{crit} = 3.85$ at $P < 0.05$). There was noteworthy distinction within the retention capacity of students instructed using discussion and lecture strategy ($r_{cal} = 0.9786 > 0.2353$ at $P < 0.05$). Male and female students instructed using the two method showed a significant difference in performance ($t_{cal} = 3.621 > t_{crit} = 2.000$ at $P < 0.05$). In conclusion, discussion instructional strategy improved performance in chemistry significantly than lecture strategy. The study concluded that discussion improved superior accomplishment and efficiency than the lecture strategy and therefore proposed to its utilization to educate natural chemistry in Nigerian Senior Secondary Schools.

2.5.4 Teaching Resources and Performance in Chemistry

Adalikwu and Iorkpilgh (2013) explored the impact of directions materials (educating helps) on students' scholastic execution in senior secondary school Chemistry in Cross Waterway State. A two bunch pre-test post-test quasi-experimental plan was received for the study. One investigate question and one theory were defined to direct the inquiry. 100 chemistry students were sampled from five senior secondary schools one (SS1) in Yakuur local Government Region of Cross Stream State through straightforward arbitrary examining and stratified arbitrary examining procedures. Fifty SSI students (Test bunch) were instructed with instructional materials and another forty (Control bunch) were instructed without the materials. A validated Chemistry Achievement Test (CAT) was used to gather data for the study and a split-half was carried out using the Pearson product moment correlation to obtain a reliability coefficient of 0.67. Free t-test was utilized to test the theory at 0.05 noteworthy level whereas the Pearson relationship coefficient at that level was utilized to analyse the research questions. It was uncovered that students instructed using instructional materials performed essentially superior than those instructed without the materials. Additionally, utilization of instructional materials enhanced students' understanding of concepts leading to high academic performance. Suggestions were made on how to progress scholarly execution of chemistry students by empowering the use of instructional materials in teaching-learning chemistry.

Chen and Wei (2015) explored the factors that influenced teachers' adjustments of the educational programs materials of the modern senior secondary chemistry educational modules, standards-based science educational modules, in China. This study was based on the preface that the interaction of the instructor with educational modules materials in a given social setting decided what happens in classroom. An interpretive approach was utilized and six chemistry instructors in four senior secondary schools took part. Classroom observation and interview were utilized as investigate strategies. The information investigation uncovered that there were seven variables that drove teachers' to adopt the use of educational programs materials, and these components were teacher's pedagogical Content Knowledge (PCK), outside examinations, time limitation, instructing assets, number of students, conviction almost science, and peer coaching. Among these variables, teacher's PCK, outside examinations, and time imperative were the more noteworthy components that affected teachers' adjustments of educational modules materials.

Gutierrez (2014) inspected the determinants of Chemistry execution of educator instruction based on students of state college and colleges in Cagayan Valley. Chemistry is an interesting subject that its usefulness is interrelated with all the varied sciences. Amazing execution within the subject is the result of the collaborative forms of the students' foundation, teaching-learning procedures in address and research facility, administration and offices. The research conducted was used to discover the determinants of Chemistry execution of educator instruction on students. The Graphic Relationship Strategy was utilized with survey checklist as instrument to accumulate pertinent information from the 297 respondents. Discoveries appeared that Chemistry was curiously and agreeable but much dreaded. Great teacher's identity and inspiration, lecture/laboratory room administration, and learning environment affected performance. Conventional strategies of instructing in spite of the fact that utilizing restricted research facility hardware and supplies/consumables influenced the execution.

2.5.5 School Administration and Performance in Chemistry

Administration could be seen as a field of study and also as a practice subjected to a number of cultural and intellectual dialogues. However, Babalola (2015a) observed that the idea of proper, effective and efficient utilization of human, material and financial resources for goal attainment had been the feature of a handful interpretations ascribed to administration.

Be that as it may, one of the major destinations of the school as an instructive industry is to proceed to select ignorant individuals of the community and refine them into valuable individuals of the society. Refining handle of the school framework includes uncovering the learners into the school educational programs beneath the gatekeepers of the instructors and the supervision and assessment of the school chairman. For compelling educating to require put, instructors need to be adequately supervised, directed, reviewed and motivated into efficiency. Babalola (2015b) expressed that school efficiency may well be measured within the standard of educating in terms of quality and amount as well as great scholastic accomplishment outside examinations. Without which the realization of the school objectives could be an illusion. In this regard, it is of enormous importance to the school administrators who are to supervise the learning opportunities to discern areas where teaching could be defective so as to strategically prevent them.

Babalola and Aliyu (2014) showed that poor academic achievement on the part of the students often lead to wastage in education. Hence, the school administrator should be very active in the curriculum and instructional (teaching) supervision of the schools to promote excellent academic achievements. Yuguda, Jailani and Yahya (2014) reported that the functions of the school administrator are supervisory where he provides textbooks, writing materials, laboratory apparatus and reagents, classroom observations, and provision of professional advice for proper improvement of teaching and learning in the school. They also motivate teachers' to achieve educational goals through effective teaching and learning process. When this is achieved it is transferred to the students and they perform better in their classroom activities. Bogale and Lemma (2019) reported that the school administrator aligns teachers' classroom objectives by providing instructional support for teachers to monitor classroom instruction, protect instructional time by ensuring teacher punctuality and reducing student absenteeism.

The current study found that practical activities done by students were not supervised and assessment was occasional. This was a weakness on the part of the school administrator. Laboratories were not well equipped with apparatus and reagents for effective practical instruction and these factors among others have affected the performance in practicals and the entire subject.

2.6 Chapter Summary

Viable work in science instruction is utilized to lock in understudies in examinations, revelations, request and problem-solving exercises. In other words, the research facility is center of science education and learning. It is outlined to assist students pick up a better thought of the nature of science and logical examination by emphasizing the disclosure approach. It gives students an opportunity to create perceptions and accumulate information valuable for the advancement of standards hence talked about within the course reading and in lesson.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents the methodology used to undertake the research. It covers the study area, research design, target population, sample design, sampling frame, data collection instruments/procedures and data analysis techniques.

3.2 Research Philosophy

Pragmatism research philosophy was used in which both quantitative and qualitative data was used to define relationships among variables of interest (Saunders, Lewis and Thornhill, 2012).The design is referred to as concurrent triangulation.

3.3 Research Design

The design selected was descriptive research design in which a sample group was used to provide information relating to the problem of study. It also involved collection of information that demonstrated relationships between variables as they exist. It enabled understanding of the problem from sampled group and the findings obtained were used to make generalizations. The type of research design concerned processes that are ongoing and effects that are evident as stated by Best and Khan (1993). Descriptive research design was appropriate for it allowed rapid collection of data through questionnaire, interview guide, observation guide and the use of documents to obtain data within the shortest time possible, without it being too expensive. Survey involved the systematic collection of data in a standardized form from a population that is identified or representative sample (Robson, 1993).

3.4 Study Area

The research study was carried out in Narok County of Kenya (appendix I). The County was selected because it lagged in the provision of quality education to its young people NAYS, (2015).Narok County is located in the Southern Rift Valley sharing borders with Republic of Tanzania to the South, Nakuru County to the North, Bomet, Nyamira, Kisii andMigori Counties to the West, Kajiado County to the East and covers an area of 17,944 km^2. It has two main rivers Mara and EwasoNyiro which pass through the Masaai Mara Game Reserve.

The temperature ranges from 8^oC to 28^oC. It has two rain seasons with mean rainfall range of between 500 to 1,800 mm per annum. The County has well developed road networks for example, the Nairobi – Bomet highway cuts through it together with other several tarmac roads.

Large and medium scale agriculture is practiced and Livestock farming and mining are also major economic activities. The illiteracy rate is high with few inhabitants in the workforce. This may be due to the nomadic lifestyle that is the main practice of the major community (the Maasai) inhabiting the County. The way of life has discouraged the provision of free education by the government. Similarly, the rates of drop-outs are high due to early marriages propagated by traditional practices in the community County Integrated Development Plan (CIDP, 2013).

3.5 Target Population

There are 145 secondary schools in Narok County. The target population of the study comprised 365 chemistry teachers and 6,314 Form three students from 145 secondary schools making a total target population to be 6679 respondents. The respondents were obtained from chemistry teachers who had been the agents of instruction in the classroom as well as have knowledge in chemistry and they are subject specialist in the school. Form three students were selected because it is a class in which many topics are practical oriented. The target was stratified to two strata that is, chemistry teachers and chemistry students. The table below shows the population that was targeted.

Table 3.1: Target Population and Sample Size

Respondents	**Target population**
Chemistry teachers	365
Chemistry Students	6,314
Total	**6679**

Source: County Education Office, (2019)

3.6 Sample Size and Sampling Procedure

The sample size was determined by using Yamane's Taro formula, $n = N / 1 + N (e)^2$. Where n= Sample size, N=Population, e= acceptable sampling error of plus or minus 5% (0.05). Hence the results were given by;

$$n = \frac{N}{1 + N(e)^2}$$

Where;

n = the sample size,

N = the population size,

e= the acceptance sampling error

$= 6679/1+6679(.05)^2$

=6679/1+16.6975

=6679/17.6975

= 377 respondents

Stratified sampling was used where stratified sample formula (Sample size of the strata = size of entire sample / population size * layer size) to calculate the proportion of respondents (Neville & Sidney, 2013);

$n_h = (N_h / N) * n$

wheren_h is the sample size for stratum h, N_h is the population size for stratum h, N is total population size, and n is total sample size as given in 3.6 above.

Table 3.2: Sample Frame

Respondents	**Target population**	**Sample distribution**
Chemistry Subject Head	365	21
Students	6,314	356
Total	**6679**	**377**

During the sampling process accessibility and proximity were considered in the vast territory of the County. Multi-stage sampling techniques were deployed. First the -schools were grouped as per the Sub-Counties where they are located using cluster sampling technique. Simple random sampling was used to select the schools to be used for study. Purposive sampling was used to select one chemistry teacher and proportion of Form three chemistry students. The sample was obtained by writing a given number of "yes"and "no" then picked by teachers and students. Those who picked yes formed a sample group. This is referred to as lottery.

3.7 Study Variables

Independent variable is one that is manipulated and therefore causes an effect on the dependent variable. During the study performance in practical depended on teacher and student activities in experiments.

Independent variable: Teacher and student activities in chemistry instruction.

Dependent variable: Performance in chemistry.

3.8 Data Collection Instruments

A questionnaire (appendix II), Interview schedule (appendix III) and observation schedule (appendix IV) were used as the main research tools in the study. The questionnaire consists of section A to E. Section A was used to obtain personal information of the respondents for example gender and whether they did chemistry subject in school. Section B-E consists of statements according to the objectives in a Likert scale of 1-5 where the respondents ticked appropriately. These were given to Form three students to fill and returned after the end of response time. Interview guide was structured into sections A to D depending on the objectives in which selected chemistry teachers were to respond to stated questions on how much they understood chemistry practical. They were filled and collected at the end of a given response time. The observation checklist consisted of statements in a Likert scale which was filled during the actual practical session. After pre-testing, the instruments were distributed as planned to the respondents.

3.9 Validity and Reliability

Validity refers to the ability to obtain data that are measurable and be able to give accurate findings upon analysis. Content validity of the instrument is improved through expert judgment. The researcher sought assistance from the supervisors. Their corrections and advice were taken into consideration and instrument was pre- tested in Bomet County. Reliability refers to ability of the instrument to give consistent results when the trials are repeated. For these two to be achieved the instrument was prepared and presented for piloting before the actual administration. The results were obtained using Cronbach Alpha for questionnaires. Alpha coefficient is between 0 to 1 higher, however for it to be reliable the value greater than 0.7. The results are presented in Table 3.3.

Table 3.3: Reliability of Instrument

Details	Cronbach Alpha	Item
Learning Competencies	.775	7
Students' Perception	.761	7
Teaching Methods	.719	6
Teaching Resources	.776	6
Chemistry Performance	.822	5
Aggregate Average	**.771**	

All the variables attained Cronbach Alpha above 0.7 with aggregate average of 0.771. Hence, learning competencies, students' perception, teaching methods, teaching resource and chemistry performance were all reliable.

3.10 Data Collection Procedure

Before collecting any information, a request for permission to collect data was made from the school, through the department to which the degree belongs that is, department of center for teacher education. Permission was sought from National Commission for Science, Technology and Innovation, NACOSTI, Ministry of Education, Narok County, provincial administration i.e office of the County Commissioner, Narok. Respective head teachers of the sampled schools were visited to inform them on the probable day of visit and finally permission was obtained from the heads of department of chemistry of the selected schools. The required number of questionnaire materials, interview guides and observation documents were printed, arranged and put in order awaiting distribution. The selected schools were then visited and the research instruments administered to the respondents through lottery and collected after an agreed lapse of time.

3.11 Data Organization and Analysis

3.11.1 Data Organization

This entailed categorizing and correcting errors, coding the data and storing in suitable form to make them clearly understood and more useful.

3.11.2 Data Analysis

At the end of the response time, the research instruments were collected and put together for editing. This involved scrutiny of the completed work to confirm their accuracy and consistency. The instruments were then coded and entered into computer software, Statistical Package of Social Scientist, (SPSS) and Analysis of variance (ANOVA) was used to test the hypotheses. The method was used compute a relationship between two variables during the study. The results were presented in form of tables.

3.12 Ethical Considerations

These are ethical principles that guided research and its participants. They include;

Informed Consent: Participants were informed before they took part in the study.

Confidentiality: The data provided by participants were protected by hiding the respondent's identity.

No force on Individuals to Participate: Respondents were given free space to provide any information as per the instrument and submit at the end of the response time

Honesty: Procedures, data collected and results, were reported honestly without any fabrication

Objectivity: was maintained by avoiding biasness. Bias was avoided during sampling, analysis and data presentation.

3.13 Chapter Summary

This chapter explains the research design and methodology that were used during data collection. The chapter also highlights the geographical location of the study area, its topography, drainage, rainfall patterns and population density. It explained sampling procedures and how research instruments were prepared for administration

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter presents data analysis, presentation, interpretation and discussion. Results of the conducted research were presented for each of the issues as were analyzed, interpreted and discussed. Presentations of results were based on the objectives of the study. Data acquired from questionnaires were analyzed using mean and frequency with the respective percentages. ANOVA was used to test the hypotheses while the interview schedule was analyzed using content analysis. The sections include response rate, demographic information and discussion of statements from the instrument as per the objectives.

4.2 Response Rate

It was found that 326 respondents returned the instruments from 356. The response rate represents 91.6% for the questionnaires given to the Form three students. 8.4% of respondents did not cooperate hence could not submit their instruments. The interview and observation response was 100% since all the 21 teachers were interviewed and results presented. A threshold of 80% and above was adequate to continue with the research according to Mugenda and Mugenda (2008). Hence the study results were sufficient to provide further analysis for the study.

4.3 Demographic Results

Demographic results on student’s questionnaire outcomes were summarized as given by the gender of the students as well as proportion of chemistry students. The results of gender of the students are presented in Table 4.1

Table 4.1: Gender of Students

		Frequency	Percent	Valid Percent	Cumulative Percent
	Male	115	35.3	35.3	35.3
Valid	Female	211	64.7	64.7	100.0
	Total	326	100.0	100.0	

Table 4.1 revealed that based on gender of the students out of 326 who were given questionnaire materials 115 were male representing 35.3% While 211 were female representing 64.7%. This study revealed there were more female than male in the schools within the region. This was a reflection from the Kenya population statistics showing more female than male persons from the 2019 census, Kenya National Bureau of Statistics KNBS, 2019. It also indicated that female students were given equal opportunities in school as male unlike in the past where most female students were forced to be married off at an early age.

The demographic information of the number of students taking chemistry indicated that 100% of students took chemistry in Form three. It revealed that chemistry has been made compulsory in secondary school education and therefore there is need to improve on the subject since it forms the basis for majority of careers in Kenyan education system.

4.4 Learner Competencies and Chemistry Performance

The results from questionnaire, interview and observation schedule are discussed in this section.

4.4.1 Questionnaire Results

Investigation on learner competencies was conducted using a questionnaire, interview and observation schedule. The information was extracted from the instruments as discussed in tandem to provide discussion for the objectives. The results from the questionnaires were presented using frequencies, percentages and mean using strongly disagree = 1, disagree = 2, neutral = 3, agree = 4 and strongly agree = 5. Mean and standard deviation was obtained from the frequency of the Likert scale. The results on learner competencies and chemistry performance were presented in the Table 4.2 below.

Table 4.2: Learner Competencies and Chemistry Performance

Questions	5(SA)	4(A)	3(N)	2 (D)	1 (SD)	Mean
The students use observation skills in chemistry practical lesson.	9(2.8%)	126(38.7%)	147(45.1%)	33(10.6%)	11(3.4%)	3.27
The students use manipulative skills in chemistry practical lesson	11(3.4%)	106(32.5%)	128(39.3%)	48(14.7%)	33(10.1%)	3.04
Chemistry knowledge is applied by students to solve practical's related problems.	15(4.6%)	111(34.0%)	154(47.2%)	31(9.5%)	15(4.6%)	3.25
Entry marks has affected learners' understanding of chemistry practical procedures.	6(1.8%)	76(23.3%)	78(23.9%)	75(23.0%)	91(27.9%)	2.48
Students' use computation skills in Chemistry practical.	16(4.9%)	126(38.7%)	131(40.2%)	37(11.3%)	16(4.9%)	3.25
Students copy the work done by others and give out affecting competence in practical	6(1.8%)	71(21.8%)	53(16.3%)	57(17.5%)	139(42.6%)	2.23
Students ability and competence in chemistry practical affect chemistry subject score	42(12.9%)	105(32.2%)	82(25.2%)	49(15.0%)	48(14.7%)	3.14

Table 4.2 gives a summary of questions that evaluated if the students used observation skills in chemistry practical. There were 9(2.8%) strongly agreed, 126(38.7%) agreed, 147(45.1%) neutral, 33(10.6%) disagreed and 11(3.4%) strongly disagreed. The results revealed that somehow the students were able to use observation skills in chemistry practicals. It implied that observation skills assisted to a smaller extent in performance in chemistry practical (mean of 3.27). Therefore, there is need to

improve the development of the skills of the students based on the low level since it is significant in the performance of chemistry practical and the subject in general. It is important to develop the skills especially by those who would like to pursue science related programs as well as engineering based courses.

It was examined if students used manipulative skills in chemistry practical lessons. The results showed 11(3.4%) strongly agreed, 106(32.5%) agreed, 128(39.3%) neutral, 48(14.7%) disagreed and 33(10.1%) strongly disagreed. It was revealed that 35.9% were in agreement as opposed to 24.8% who disagreed. This meant that manipulation skills were practiced to a smaller extend in chemistry practical (mean of 3.04). Manipulation skills being one of the competencies that assist students to handle chemistry practical activities needs to be well developed for it is crucial in obtaining data for problem solving.

The results from assessment if chemistry knowledge was applied by students to solve practical related problems are given. The responses indicated that to a small extent 15(4.6%) strongly agreed, 111(34.0%) agreed, 154(47.2%) neutral, 31(9.5%) disagreed and 15(4.6%) strongly disagreed. A mean of 3.25 confirmed that knowledge from chemistry was applied in small extent in solving practical problems. Most respondents could not understand knowledge applicability in chemistry subject. There is need for students to develop understanding of chemistry subject content to enable them apply such knowledge in practical activities for better performance.

Practicals were assessed using the question if entry marks affected the understanding of chemistry practical procedures. It was found that 6(1.8%) strongly agreed, 76(23.3%) agreed, 78(23.8%) neutral, 75(23.0%) disagreed and 91(27.9%) strongly disagreed. The results showed that 25.1% agreed as opposed to 50.9% who disagreed.

It implied that entry mark affected to a small extent performance in chemistry practicals. The mean of 2.48 implied that entry behaviour of learners affected chemistry but to a smaller extent. This indicated that students can improve their performance despite the entry behaviour.

Students' computation skills were evaluated on utilization in chemistry practicals. It was found that 16(4.9%) strongly agreed, 126(38.7%) agreed, 131(40.2%) neutral, 37(11.3%) disagreed and 16(4.9%) strongly disagreed. The students were found to utilize computation skills with a small extent in chemistry practicals (mean of 3.25). It is important to develop the skill since it helps the students handle practical problems that affect performance of the students.

Students copy the work done by others and give it out was analyzed on its effect to competence in practicals. Those who strongly agreed were 6(1.8%), 71(21.8%) agreed, 53(16.3%) neutral, 57(17.5%) disagreed and 139(42.6%) strongly agreed. Those who generally agreed represented 23.6% and 60.1% disagreed. It implied that most students believe that copying or cheating during chemistry practices in the laboratory does not affect their performance (mean of 2.23). Despite that, it has been a bad vice though most students support the fact that copying was not bad and does not affect their capabilities in chemistry. It is then very crucial to uphold morality and reduce mal practices in secondary school not only in chemistry practicals but also in other subjects. All stakeholders from government, school administration, teachers, students and parents should impact good morals that assist students in eliminating examination malpractices in the entire education system.

Students ability and competence in chemistry practical were investigated where 42(12.9%) strongly agreed, 105(32.2%) agreed, 82(25.2%) neutral, 49(15.0%)

disagreed and 48(14.7%) strongly disagreed. The results revealed that students' ability and competence in chemistry practicals had influence on the scores in chemistry subject to smaller extent (mean of 3.14). Therefore, it revealed that schools have to improve students' competence and skills in chemistry practicals to enable them perform well in the subject.

4.4.2 Interview Results

Interview results showed that majority of students had low observation, manipulation, and computation skills. The teachers had been trying to improve the skills as well as competence of the students. However, some teachers claimed that some students with low entry marks had poor observation skills which were anchored on the foundation of science at primary level. This was evidenced by teacher 12 who claimed that"students had poor observation skills which is attributed to poor foundation in science affecting their performance in chemistry". This did not deter performing schools where chemistry teacher 10 claimed that "our school has adequate and conducive environment that make students develop observation skills which assisted in improving performance in chemistry practicals and the subject at large". This was seconded by chemistry teacher 3 who said "we have enjoyed good performance in Chemistry since the school has given us resources and a conducive environment where students develop and utilize observation skill. This has contributed to better performance in chemistry practicals and the subject in general in our school". On the contrary schools with inadequate laboratory apparatus and reagents had problems when it comes to making observations during chemistry practical sessions.

In response to whether the students were able to manipulate apparatus during practical session. There were 12 teachers against 9 who agreed that their students were not capable of using manipulation skills. It indicated that there were insufficient manipulation skills among students and required utilization of innovative instructional methods to equip them with necessary abilities for better performance.

The response to whether the students were able to compute practical data to solve problems or not. Majority of the teachers responded that most of the students had challenges in computation of data. According to chemistry teacher 1, “Yes, most of the students are unable to link the data obtained to the taught concepts of moles, chemical equations and qualitative analysis”. Chemistry teacher 3 responded that, “No, the students are introduced to practicals mainly in Form Four due to late coverage of syllabus leading to inadequate development of computation skill required in summative evaluation. Those who responded that majority of students had low abilities in computation were 11 out of 21 chemistry teachers representing 52.4%. They cited the main challenge as low competencies based on their background and lack of sufficient practical exposure.

Majority of chemistry teachers claimed that entry behaviour played a significant role in performance of students. Chemistry teacher 21 claimed that “Yes, students who had poor background in science when joining secondary school had poor foundation of major skills necessary in the development of competencies in science based subjects. There were 14 chemistry teachers representing 66.7% who claimed that entry behaviour did have significant impact on students’ performance. On the contrary those who disagreed claimed that with right resources and environment, students with poor background in science had equal chance of improving in science related subjects. Chemistry teacher 3 commented “no, with well-equipped laboratory and conducive environment students with poor entry behaviour can do well in chemistry practicals and the subject in general”.

4.4.3 Observation Results

The results from observation were based on the assessment of what was observedduring the actual practical sessions in the selected twenty one secondary schools, N=21. Data were entered into observation schedule where mean and standard deviation were obtained.

Table 4.3: Observation on Learner Competencies

	N	Mean	Std. Deviation
Student have strong ability to make observations	21	2.5238	.67964
Student are able to follow instructions in chemistry practical	21	2.4762	.51177
Student are knowledgeable in practical sessions	21	2.9048	.76842

Table 4.3 revealed that students somewhat had low observation skills (mean of 2.5238). Variance was low in observation skills (standard deviation of .67964). Majority of students were not able to follow instructions in chemistry practicals (mean of 2.4762). There was low dispersion in following instructions (standard deviation of .51177). Finally, students were knowledgeable to small extent in practical sessions (mean of 2.9048). Variance was low in knowledge ability of students (standard deviation of .76842). The observed information concurs with student's information which indicated low observation, manipulation, application of knowledge and computation skills among students. Therefore, it was evident that students' utilization of science skills and competence was low in the schools examined and this has contributed to poor performance in chemistry practical paper and the entire subject.

4.4.4 ANOVA Results

Analysis of variance was done on learner competencies against chemistry performance and the following results were achieved using 5% significant level.

Table 4.4: ANOVA on Learner Competencies and Chemistry Performance

			Sum of Squares	df	Mean Square	F	Sig.
Perform in chemistry practical * Ability and competence	Between Groups	(Combined)	33.261	4	8.315	13.271	.000
	Within Groups		201.123	321	.627		
	Total		234.383	326			

The ANOVA results indicated that learner competencies affected the performance in chemistry significantly ($F_{(P=5\%,\ 4,321)}$ =13.271, P = 0.000 <0.05). F- ratio between group variance to within group is 13.271. Since its closer to the mean, then variance is low. P< 0.05% since the value is below 5% shows there is a significant relationship between variables. Null hypothesis is rejected and alternative hypothesis is accepted. It implied that learner competencies had significant influence on performance in chemistry practical.

4.4.5 Discussion on Learner Competencies and Chemistry Performance

Learner competencies include observation, manipulation and computation skills. The study finding indicated that majority of students had low observation skill in chemistry practicals (mean of 3.27). The utilization of manipulative skill in chemistry practicals was low (mean of 3.04). A mean of 3.25 confirmed that knowledge from chemistry content was utilized to a small extent in solving chemistry practical problems. The students' computation skill was found to be low with a mean of 3.25.

The three major skills are crucial in chemistry practical activities yet were not well developed and utilized by students in the study. The results concur with the findings from observation schedule that student's ability to follow instructions and utilize learned knowledge in chemistry was below average affecting performance in chemistry practicals.

Entry behaviour affected the performance in chemistry practicals to a small extent mean of 2.48. Concurring with teacher's view where entry behaviour of students had significant impact on performance. On the contrary, with adequate resources and conducive learning environment students with low entry performed well in chemistry practicals and the subject in general. Students who copied the work done by others affected their competence in practicals to small extent mean of 2.23. However, students' abilities and competence impacted the performance in chemistry practical to a small extent mean of 3.14 and this has affected the students' scores.

ANOVA results indicated that learner competencies has significant effect on performance in chemistry practical ($P < 5\%$). The competencies are observation, manipulation, computation and problem solving skills that had significantly affected the performance in chemistry practical and the subject in general. The students indicated low levels of the skills which have contributed to poor performance.

These results concur with Lucenario, Yangco, Punzalan and Espinosa (2016) who found that science competencies of students and teachers significantly affected performance in science based subjects' chemistry, biology, environmental science, mathematics and physics. The current research associated performance with low application of observation, manipulation, computation and problem-solving skills in chemistry practicals. This was supported by Lucenario et al, (2016) especially problem-solving skills which increased the mean score of students' despite intervention of Pedagogical Content Knowledge-Guided Lesson.

Learner competencies affected the performance of both boys and girls negatively since the skills were not well developed but in another related study by Vincent-Ruz and Schum (2017) learner competencies affected positively the performance of girl's. Teacher's competence was found to have positive significant effect on student's academic performance, despite the study concentrating on teacher's competence rather than students' competence. Similarly, Copriady (2014) found that teacher competencies play a significant role in student's academic performance. Arokoyu and Needom (2019) also found that teacher's competence in handling volumetric analysis depended on their qualification and was translated to students' performance. However, that was not clarified whether the teachers' competence or any other factor was associated with low science competence and skills level of the students in chemistry practicals. Therefore, teacher competence in chemistry practicals proposedly associated with science competencies of the students' which affect performance in chemistry.

According to Adlim et al, (2013) low performance in rural schools was associated with students who had low competencies which concurred with the current research. These are some of the factors that affect the current research, since the results indicated that learner competencies were at low level in this study which explained the reason for poor performance in practicals and the entire subject.

4.5 Students' Perception and Chemistry Performance

Questionnaire, interview and observation results were presented and discussed below.

4.5.1 Questionnaire Results

This section presents the results from investigation on students' perception on performance in chemistry practicals. It was evaluated using frequencies and percentages. Mean value was used in interpretation. Likert scale was coded as 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree.

Table 4.5: Students' Perception and Chemistry Performance

Questions	5(SA)	4(A)	3(N)	2 (D)	1 (SD)	Mean
Students like chemistry practical developing positive attitude towards the subject	21(6.4%)	108(33.1%)	111(34.0%)	60(18.5%)	26(8.0%)	3.12
There is positive perception towards chemistry practical in the school	20(6.1%)	120(36.8%)	128(39.3%)	26(8.0%)	32(9.8%)	3.21
Students like chemistry teachers especially in practical lessons	29(8.9%)	119(36.5%)	94(28.8%)	60(18.4%)	24(7.4%)	3.21
Perception towards the school and its performance affect chemistry practical.	10(3.1%)	71(21.8%)	86(26.4%)	79(24.2%)	80(24.5%)	2.55
Chemistry is easy subject to be understood	15(4.6%)	89(27.3%)	117(35.9%)	53(16.3%)	52(16.0%)	2.88
Chemistry practicals are easy to be done than other subjects	17(5.2%)	88(27.0%)	103(31.6%)	69(21.2%)	49(15.0%)	2.86
Positivity in chemistry practical contribute on the performance of the subject	80(24.5%)	129(39.6%)	64(19.5%)	17(5.3%)	36(11.1%)	3.61

Table 4.5 revealed the effect of students' perception in chemistry practical performance. Students were asked if they liked chemistry developing positive attitude

towards the subject. The findings indicated that 21(6.4%) strongly agreed, 108(33.1%) agreed, 111(34.0%) neutral, 60(18.5%) disagreed and 26(8.0%) strongly disagreed. This implied that students liked the subject to smaller extent affecting the development of positive attitude towards chemistry practicals (mean of 3.12).

Response on whether there was positive perception towards chemistry practical in school. 20(6.1%) strongly agreed, 120(36.8%) agreed, 128(39.3%) neutral, 26(8.0%) disagreed and 32(9.8%) strongly disagreed. There was slightly low positive perception towards chemistry practicals in public secondary schools (mean of 3.21). The low perception had detrimental impact on the performance of the subject.

The response on whether the students liked chemistry teachers especially during practical lessons showed 29(8.9%) strongly agreed, 119(36.5%) agreed, 94(28.8%) neutral, 60(18.4%) disagreed and 24(7.4%) strongly disagreed. The results revealed that students moderately liked chemistry teachers (mean of 3.21). The right attitude towards the teacher contributed to good performance to some extent and vice versa.

Perception towards the school was also investigated in relation to performance it had in chemistry practicals. The findings indicated 10(3.1%) strongly agreed, 71(21.8%) agreed, 86(26.4%) neutral, 79(24.2%) disagreed and 80(24.5%) strongly disagreed. Perception towards the school and its performance affected chemistry practical a mean of 2.55.

The students were asked if chemistry practicals were easy to be understood. Those who strongly agreed were 15(4.6%), 89(27.3%) agreed, 117(35.9%) neutral, 53(16.3%) disagreed and 52(16.0%) strongly disagreed. The students somehow disagreed that chemistry practicals were easy to understand (mean of 2.88). There were slightly more students who found chemistry practicals to be difficult than those who found to be easy. This made the students to perform poorly in practicals and eventually the entire subject.

On response to the ease of doing chemistry practicals the results revealed that 15(4.6%) strongly agreed, 89(27.3%) agreed, 117(35.9%) neutral, 53(16.3%) disagreed and 52(16.0%) strongly disagreed. Chemistry practicals were not easy to be done than other subjects (mean of 2.88). Therefore, it was found to be somehow difficult to majority of students.

Finally, the findings on positivity of students on chemistry practicals revealed that 80(24.5%) strongly agreed, 129(39.6%) agreed, 64(19.5%) neutral, 17(5.3%) disagreed and 36(11.1%) strongly disagreed a mean of 3.61. Hence it implied that positivity in practical subject assisted the students to perform well in the subject but this was contrary to the study where most students had preconceived attitude of difficulty in handling practicals hence affecting their performance negatively.

4.5.2 Interview Results

Interview results from chemistry teachers indicated that majority of students had negative attitude towards chemistry subject. Chemistry teachers had been trying to create positive attitude by encouraging and inviting motivational speakers. According to chemistry teacher 1, “students liked chemistry since the school has science and mathematics as the best performed subjects.” Chemistry teacher 2 mentioned that “there is poor attitude based on lack of sufficient resources which affect the teaching technique and practical lessons.” Majority of chemistry teachers’ indicated that negative student’s attitude was related with the environment which include the chemistry teacher, school and chemistry subject. On the contrary, Chemistry teacher

13 argued that “majority of students disliked chemistry subject because of continuous poor performance in the previous years”.

Majority of teachers reported that students perceived chemistry practicals as tasking, difficult and needed continuous practices. According to Chemistry teacher 14, “students perceived practicals negatively and required continuous activities to develop skills necessary for evaluation’’. There were 13 chemistry teachers who pointed out that students perceived chemistry practicals as difficult representing 61.9% and 9 chemistry teachers representing 38.1% perceived it as an easy subject.

Another investigation on whether students had positive perception towards the chemistry teachers. Some teachers indicated that some students had negative perception towards their teachers due to the way they perceived the subject as difficult. Those teachers who argued that their students had negative attitude towards them were 11 representing 52% but those who had positive attitude were 10 representing 48%. Chemistry teacher 3 alluded that “the teachers related with students’ in class, despite others who have developed negative stand on the subject”.

Further, chemistry teachers argued that students with positive attitude towards their schools performed better than those who had negative attitude. However, Chemistry teacher 14 commented that “students have positive attitude towards their teachers as well as their schools which has contributed to better performance of the subject”. On the contrary Chemistry teacher 20 alluded that, “the poor performance of students is based on poor management and lack of resources which has made students develop negative attitude towards the school.”

4.5.3 Observation Results

Observation was carried out in twenty one selected secondary schools, N=21 during actual practical activities. Data was analyzed to obtain mean and standard deviation.

Table 4.6: Observation on Students' Perception

	N	Mean	Std. Deviation
Students participates actively in practical session	21	3.0476	.66904
Students are motivated in chemistry practical sessions	21	2.3333	.48305
Students enjoy chemistry practical	21	2.7619	.53896

Table 4.6 showed that students participated actively in practicals to small extent (mean of 3.0476). It had low variation (standard deviation of .66904). The students' motivation was low in chemistry practicals (mean of 2.3333). Dispersion was low (standard deviation of .48305). Student somewhat to small extent enjoyed chemistry practicals (mean of 2.7619). Variation was low (standard deviation of .53896).

4.5.4 ANOVA Results

Analysis of variance (ANOVA) was used to test the significance of each variable on chemistry performance to support descriptive statistics and come up with conclusions on the research hypotheses.

Table 4.7: ANOVA Students Perception and Chemistry Performance

			Sum of Squares	df	Mean Square	F	Sig.
Perform in chemistry practical * Students perception	Between Groups	(Combined)	92.300	4	23.075	52.132	.000
	Within Groups		142.083	321	.443		
	Total		234.383	326			

Table 4.7 ANOVA results indicated that students' perception on chemistry practicals was a significant determinant on chemistry performance ($F_{(P=5\%,\ 4,321)}$ =52.132, P = 0.000 <0.05). F- ratio is 52.132 shows greater dispersion. P< 0.05% value is below 5% shows that there is a significant relationship between variables. Null hypothesis is rejected and alternative hypothesis is accepted. It implied that students with negative perception on chemistry practicals and the chemistry teacher performed poorly and the contrary is true. Therefore, student's perception affected significantly the performance in chemistry practical.

4.5.5 Discussion on Student's Perception and Chemistry Performance

Student's perception is a mere emotional state rather than physical state. Hence it affected students' behaviour in both emotional and psychological part of learning. Students liked chemistry to small extent mean of 3.12. It was also indicated that there were slightly more students who had positive perception than negative perception towards chemistry in the schools (mean of 3.21) but chemistry teachers indicated that majority of the students had negative attitude towards chemistry subject because they perceived the subject to be difficult to handle which affected their outcomes in summative evaluation. This concurred with results from students where chemistry was seen as a difficult subject (mean of 2.88). Students to smaller extent liked chemistry teachers a mean of 3.21. The students who had positive attitude towards the subject teacher and the school had the subject performed better in the school to small extent. Some students had negative attitude towards the subject and the teacher and performed poorly in examinations.

Perception towards the school and its performance affected chemistry practicals a mean of 2.55. Chemistry practicals were somehow difficult to be done mean of 2.88. Positivity in chemistry contributed to the good performance a mean of 3.61. Therefore, positive perception and attitude towards subject, school or teacher had significant impact on overall performance. However, perception and attitude towards chemistry, school or teacher were found to be more of negative in the study which affected students' performance in summative evaluation.

Further results from ANOVA indicated that student's perception on chemistry practicals is significant determinant onchemistry performance ($P<0.05$). Perception aspect that affected student's was negative perception towards chemistry, school and chemistry teachers which was associated with poor performance in the region. From observation point of view student's participation was active to a small extent but there was low enjoyment as well as motivation in chemistry practicals. Therefore, the current study found that student's negative perception had significant effect on performance in chemistry practicals. The current study concurred with Mahdi (2014) who found that perception of students had significant role on performance in chemistry. The results associated students' perception to chemistry knowledge, understanding of concepts and career selection to chemistry related fields. Perception to chemistry in the current research was related to negative attitude towards the teacher, school and subject which affected performance in Chemistry negatively.

The current research was in line with Odutuyi (2012) who found that attitude affected performance of students' in secondary school education. The study revealed similar findings in teacher-student relationship as one of the factor that affected student perception but the current research found that student attitude towards school and subject also contributed to performance in chemistry.

Chepkorir*et al* (2014) found that there were other factors that affected performance of students which included lack of experiences in Chemistry and poor teaching. The current study concurs with Chepkorir on the student attitude towards the teacher contributed by experience and teaching method of the teacher being significant factor that caused negative attitude.

Therefore, negative attitude of the teacher from majority of research which was in line with the current research was the major cause of students' negative attitude towards the subject. This meant that the teachers can affect performance of the subject directly through the attitude passed to the students. Furthermore, attitude towards the school and subject are then highly correlated with that of chemistry teacher. There is need for teachers to develop and improve the attitude towards the subject through encouraging and developing positive environment.

4.6 Teaching Methods and Chemistry Performance

The results of teaching methods and Chemistry performance were discussed from questionnaire, interview and observation schedule.

4.6.1 Questionnaire Results

In order to determine the effect of teaching methods on the chemistry performance frequencies, percentages and mean were used. The mean value was calculated from Likert scale using codes where 1= strongly disagree, 2 = disagree, 3 = neutral, 4 =

agree and 5 = strongly agree. The results from the questionnaire were presented in Table 4.8.

Table 4.8: Teaching Methods and Chemistry Performance

Questions	5(SA)	4(A)	3(N)	2 (D)	1 (SD)	Mean
The teacher uses chemistrypractical lessons to teach.	22(6.7%)	48(14.7%)	70(21.5%)	76(23.4%)	110(33.7%)	2.37
The teacher often conduct chemistry practical during practical lessons	27(8.3%)	83(25.5%)	95(29.1%)	81(24.8%)	40(12.3%)	2.93
The teacher demonstrates the process of titration as the learners observes	40(12.3%)	71(21.8%)	113(34.6%)	64(19.6%)	38(11.7%)	3.03
The students does practical without supervision of the teacher	36(11.0%)	88(27.0%)	113(34.7%)	71(21.8%)	18(5.5%)	3.16
The teacher assess the learners as they proceed with chemistry practical	39(12.0%)	88(27.0%)	108(33.1%)	56(17.2%)	35(10.7%)	3.12
Students are motivated by the teaching method deployed by the chemistry teacher during practical lessons	47(14.4%)	120(36.8%)	93(28.6%)	44(13.5%)	22(6.7%)	3.39

Table 4.8 investigated teaching methods on performance in chemistry practical. The results revealed that majority of teachers did not use chemistry practical lessons to teach chemistry where 22(6.7%) strongly agreed, 48(14.7%) agreed, 70(23.3%) neutral, 76(23.4%) disagreed and 110(33.7%) strongly disagreed. However, few teachers used chemistry practical lessons to teach chemistry theory (mean of 2.37) as

compared to those who did not. This indicated that there are teachers who converted practical lessons to teach chemistry content.

The question on whether the teachers conducted chemistry practicals during practical lessons. The findings were 27(8.3%) strongly agreed, 83(25.5%) agreed, 95(29.1%) neutral, 81(24.8%) disagreed and 40(12.3%) strongly disagreed. This implied that teachers often conducted chemistry practical to a small extent during practical lessons (mean of 2.93). Therefore, some of the practical lessons were converted to teach chemistry content denying the students opportunity for practical exposure.

The findings revealed that 40(12.3%) strongly agreed, 71(21.8%) agreed, 113(34.6%) neutral, 64(19.6%) disagreed and 38(11.7%) strongly disagreed that teachers demonstrated titration experiments as the students observed a mean of 3.03. It implied that demonstration method was used to a small extent as indicated by the results.

The students did carry out practicals on their own without supervision of the teacher to some extent. This explained by 36(11.0%) strongly agreed, 88(27.0%) agreed, 113(34.7%) neutral, 71(21.8%) disagreed and 18(5.5%) strongly disagreed. The results indicated that to small extent students carried out practical lessons on their own without supervision of the teachers (mean of 3.16). This teaching method might result to low performance where there is no supervision of students during the actual practical activities.

According to the results on if teachers assessed the students as they proceed with practicals, 39(12.0%) strongly agreed, 88(27.0%) agreed, 108(33.1%) neutral, 56(17.2%) and 35(10.7%) disagreed. The teachers moderately assessed the students as they proceed with practicals (mean of 3.12). Low assessment as indicated by the results impacted negatively on chemistry practical performance and the entire subject.

It was also investigated if students were motivated by the teaching method deployed by the chemistry teachers during practical lessons. It was found that 47(14.4%) strongly agreed, 120(36.8%) agreed, 93(28.6%) neutral, 44(13.5%) disagreed and 22(6.7%) strongly disagreed. Hence, chemistry teachers deployed teaching methods that made the students to be motivated when handling practical to small extent (mean of 3.39). There is need to improve on the teaching methods utilized for better performance. Practical subject requires adaptation of innovative pedagogy for example use of integrated computer technology and simulations to enable the students internalize instructions and enhance motivation.

4.6.2 Interview Results

Interview results on the use of lecture methods in instruction of practical content showed that majority of the teachers' integrated lecture with experimental method in content delivery. Chemistry teacher 3 alluded that "I utilized lecture method when reviewing the lesson, introducing the topics and explaining concepts. I integrate the method with demonstration before the students handle actual experiments. This was possible because majority of practical lessons are double (80 minutes) which gives enough time for utilization of the methods."

In response on how often they carried out practical in chemistry, the entire respondents indicated that chemistry practical were done as timetabled while the single lessons were utilized for teaching chemistry theory. A few Chemistry teachers used extra time on Saturday to further their chemistry practicals. For instance, Chemistry teacher 3 commented that "yes, we often conduct practicals as per the timetable. But sometimes we utilize free time, morning or evening hours to give the students more practicals which have significantly improved the performance of chemistry as a subject in our school”. Interview question that examined if the chemistry teachers demonstrated practical activities showed that majority utilized demonstration method before students conducted practicals on their own. Demonstration made the students understand the processes. This was explained by chemistry teacher 5, “teachers must demonstrate the practical since it enabled the students to understand how to manipulate the apparatus. The notion that chemistry practicals are hard could be demystified through demonstration enabling the students develop both knowledge and positive attitude towards the subject”.

Finally, all teachers commented that chemistry practical was handled both individually or in groups based on availability of apparatus and reagents and the intensity of the practical. The response from chemistry teacher 10 alluded that “Both are significant and there are some practicals that needed individual students to conduct especially titration since the skills must be impacted to the individual. Some needed group based due to lack of sufficient apparatus and reagents or they needed general demonstration where the reagents reacted explosively like sodium and potassium based experiments”. This showed conclusively that individual practical or group practical or demonstrations are applied at different levels to pass a specific skill based on resource availability. Despite the use of demonstration, practical or lecture method teachers interviewed did not point to the use of innovative methods which could have assisted in improving performance.

4.6.3 Observation Results

Observation was carried out in twenty one selected secondary schools and the data was analyzed to obtain mean and standard deviation. The results were presented in Table 4.9

Table 4.9: Observation on Teaching Methods

	N	Mean	Std. Deviation
Students are allowed to discuss and ask questions in the practical session	21	3.0476	.66904
Students have high practical skill	21	2.5714	.59761
Teachers assessed the practical done by the students	21	2.8095	.67964

Results from table 4.9 indicated that students were allowed to discuss and ask questions to low extent during the practical session (mean of 3.0476). Variation was low in students' discussion and question asking (standard deviation of .66904). Students had low practical skills (mean of 2.8095). Variation was low in practical skills (standard deviation of .59761). Teachers assessed the student's practicals to small extent (mean of 2.8095). Variation was low in practical assessment (standard deviation of .67964).

4.6.4 ANOVA Results

The finding of teaching method and chemistry performance were further investigated using ANOVA analysis indicated below.

Table 4.10: ANOVA on Teaching Methods and Chemistry Performance

			Sum of Squares	df	Mean Square	F	Sig.
Performance in chemistry practical * Teacher contribution	Between Groups	(Combined)	80.112	4	20.028	41.673	.000
	Within Groups		154.271	321	.481		
	Total		234.383	326			

In table 4.10 indicated that teaching methods used in chemistry practical had significant influence on performance in chemistry ($F_{(P=5\%,\ 4,321)}$ =41.673, P = 0.000 <0.05). F- ratio is 41.673 means there was greater dispersion. P< 0.05% value is less than 5% means that there is a significant relationship between variables. Null hypothesis is rejected and alternative hypothesis is accepted. The results revealed that teaching methods play a major role on performance in chemistry as a subject.

4.6.5 Discussion on Teaching Methods and Chemistry Performance

The results indicated that majority of teachers did not use chemistry practical lessons efficiently mean of 2.37. Few of the teachers were found using chemistry practical lessons for actual practical purposes while some used the lessons to teach chemistry content. This had negative impact on practical since the time allocated was not utilized for practices. The results also revealed that demonstration method, practical with no supervision and teacher assessment were utilized to smaller extent (mean of 3.03, 3.16 and 3.12 respectively). This revealed that there was need for schools to adopt innovative teaching techniques that are student oriented and motivating to improve performance in chemistry. The current teaching methods used are not student motivating mean of 3.39. Majority of teachers integrated lecture with experimental method for content delivery. Demonstration method was utilized before the students could handle the experiments on their own.

Laboratory activities were done individually or in groups depending on the nature of experiments and availability of apparatus although this was affected by lack of supervision and assessment which was done occasionally. This made the students perform below average in practical exams and the entire subject. There is need to adopt innovative instructional methods that would allow students develop required skills for examination and be motivated towards the subject. When student centered methods are used with proper supervision and assessment they improve on performance and on the contrary, where students are left to work on their own without supervision and assessment they will not perform well in practicals and in the final examination.

ANOVA results revealed that teaching methods in chemistry practical are significant to performance in chemistry ($P<0.05$). Demonstration and supervised practicals, assist in improving performance in chemistry practicals. But in the study practical supervision, assessment and question asking were low making students to develop skills to a small extent. This affected practical outcomes and performance in the subject negatively. This concurred with observation results where students discussed and asked questions to a small extent and had low practical skills as well as their teachers did not often assess them in practicals. The results concurred with Alade and Ogbo (2014) who found that learning style applied has significant effect on the performance in chemistry. They were associated with visual learning style which was highly utilized and had positive effect on performance while the current research used lecture, demonstration and student practical that lacked supervision. This showed that there is need for a shift towards Integrated Computer Technology (ICT) to improve performance in chemistry and other science based subjects.

Okwiduba and Okigbo (2018) found significant effect of teaching methods on academic performance with respect to problem solving, student group learning and instructional material based learning as well as simulation which contributed positively on academic performance. The current study found that majority of schools still adopted traditional teaching methods that were teacher centered but students participated in practical activities with less supervision which reduced the effectiveness of the teaching method.

On the contrary Uzezi and Zainab (2017) investigation on Guided-Inquiry Laboratory Experiment showed that it had significant improvement effect as compared with traditional methods in volumetric analysis. The current research which is mainly traditional through demonstration can be improved to enable students gain problem solving experiences and other skills through Guided-Inquiry Laboratory Experiment. Similar results were also found by Ibrahim *et al*, (2018) where inquiry method had significant effect on academic performance than traditional methods. Their findings cut across all the subjects taught to students contrary to Uzezi and Zainab (2017) where it concentrated on Chemistry.

In a related research by Danili and Reid (2012) based on strategies to improve performance showed that teaching methods were highly dependent on laboratory materials and resources where experimental group performed better than controlled group (group instructed using traditional methods). It is important to improve in resource allocation. Similarly, cooperative instructional group was experimented where the results obtained showed that there was improvement than traditional methods. The current research finding indicated that majority utilized demonstration method hence there is need to improve on teaching methods in Kenyan secondary schools.

Discussion method was also found to be significant according to Omwirhiren (2015) which was contrary to the current research where demonstration and student based experiment with less supervision were studied. Discussion method used by the experimental group performed better in Chemistry than controlled group who used lecture method. Therefore, there is need to improve the instructional methods through adopting new methods like cooperative methods, computer based learning and guided inquiry laboratory methods in chemistry practicals as opposed to the traditional methods.

4.7 Teaching Resources and Chemistry Performance

The results from questionnaire, interview and observation schedule were presented in this section.

4.7.1 Questionnaire Results

Teaching resources were evaluated against performance using the student questionnaire. Likert scale used was coded as 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree, which was used to obtain frequencies and percentages of total frequency. These were used to obtain the mean that was used for interpretation as represented in Table 4.11 below.

Table 4.11: Teaching Resources and Chemistry Performance

Questions	5(SA)	4(A)	3(N)	2 (D)	1 (SD)	Mean
Chemistry apparatus are sufficient during practical lessons.	9(2.8%)	34(10.4%)	145(44.5%)	109(33.4%)	29(8.9%)	2.65
There is sufficient time allocation for chemistry practical lessons	32(9.8%)	45(13.8%)	171(52.5%)	72(22.1%)	6(1.8%)	3.08
Chemistry teachers provide sufficient reagents during practical sessions	17(5.2%)	64(19.6%)	118(36.2%)	82(25.2%)	45(13.8%)	2.77
There are sufficient chemistry teachers and lab technicians for running chemistry practical	62(19.0%)	72(22.1%)	65(19.9%)	119(36.5%)	8(2.5%)	3.19
The teacher assess the learners as they proceed with chemistry practical	30(9.2%)	52(16.0%)	114(34.9%)	113(34.7%)	17(5.2%)	2.89
Laboratory is well equipped with chemistry reagents and apparatus for conducting practical.	7(2.1%)	21(6.4%)	148(45.5%)	108(33.1%)	42(12.9%)	2.52

Table 4.11 presents students' responses on teaching resources and chemistry performance. The results indicated that chemistry apparatus were somehow not sufficient during practical lessons, where 9(2.8%) strongly agreed, 34(10.4%) agreed, 145(44.5%) neutral, 109(33.4%) disagreed and 29(8.9%) strongly disagreed. Therefore, chemistry apparatus were not enough during practical lessons (mean of 2.65). This mostly made students share or perform the practicals in shifts.

It was found that 32(9.8%) strongly agreed, 45(13.8%) agreed, 171(52.5%) neutral, 72(22.1%) disagreed and 6(1.8%) strongly disagreed that there was sufficient time allocation for chemistry practical lessons (mean of 3.08). The results indicated that time allocation was somehow sufficient for chemistry practical lessons.

The response to whether chemistry teachers provided sufficient reagents during practical sessions indicated that 17(5.2%) strongly agreed, 64(19.6%) agreed, 118(36.2%) neutral, 82(25.2%) disagreed and 45(13.8%) strongly disagreed. A mean of 2.77 indicated that chemistry teachers did not provide sufficient reagents to be used in practical sessions.

It was investigated if there were sufficient chemistry teachers and laboratory technicians' to administer practicals. The response were 62(19.0%) strongly agreed, 72(22.1%) agreed, 65(19.9%) neutral, 119(36.5%) disagreed and 8(2.5%) strongly disagreed. Therefore, to small extent chemistry teachers and lab technicians were sufficient to facilitate chemistry practicals (Mean of 3.19).

According to the results teachers assessed the learners as they proceeded with chemistry practical to some extent where 30(9.2%) strongly agreed, 52(16.0%) agreed, 114(34.9%) neutral, 113(34.7%) disagreed and 17(5.2%) strongly disagreed. Hence it implied that teachers assessed the learners during practicals to small extent (mean of 2.89).

Results also indicated that the laboratory contained apparatus and reagents necessary for conducting practical to small extent since 7(2.1%) strongly agreed, 21(6.4%) agreed, 148(45.5%) neutral, 108(33.1%) disagreed and 42(12.9%) strongly disagreed. It implied that most laboratories had apparatus and reagents for conducting practical (mean of 2.52) but were not adequate to accommodate individual student activities.

4.7.2 Interview Results

Interview schedule was utilized to interrogate chemistry teachers on the effect of teaching resources on performance in chemistry. This followed an interview question inquired if practical apparatus were available for chemistry practicals. Teachers accepted that apparatus and reagents were available but not sufficient. The main issue stated by the chemistry teachers was the adequacy of the apparatus since majority of the schools did not have sufficient apparatus that led them to put their students in groups and also performed the experiments in shifts. Chemistry teacher 12 commented that “the main challenge in apparatus is not the availability but the adequacy. The apparatus is sufficient to cover a class of 50 students and often we create shifts to enable individual participation. This forced majority of chemistry teachers to conduct group experiments where each experiment was conducted by three to five students depending on the available apparatus”. This argument of chemistry teacher 12 was shared by majority of chemistry teachers. Some associated poor performance of chemistry to inadequacy of laboratory resources. Chemistry teacher 21 alluded that, “The poor results that we have are contributed by other factors but the major challenge in our school is lack of sufficient apparatus which has crippled chemistry teachers’ effort to reverse the trend of poor performance. The day secondary schools should be allocated more funds to purchase apparatus, reagents and build laboratories for better chemistry performance.”

The second interview question on teaching resources was that majority of respondents agreed time was sufficient but the challenge was practical allocation. Chemistry teachers argued that if the laboratory had sufficient space, apparatus and reagents the time allocated in the timetable was sufficient and they could not find extra time during weekends, morning and evening for practicals. According to teacher 6 argument, “the time is not the problem here but the available resources which is always the issue''. "In some practicals to test individual competence, we divide the class into three to four shifts so that individual students perform the experiments''. This forced the chemistry teachers to organize for individual practical sessions during the weekends to have adequate space and apparatus for the experiments. "But often we are forced to conduct experiments in groups which fit the time allocated in the timetable". This was replicated in other responses where time allocation depended on whether it's group or individual practical. It depended on the space and physical resources available.

Interview of whether there were sufficient reagents for chemistry practicals revealed that the sufficiency differed with different schools. According to the results it was found that schools that had resources mostly the National and extra-County schools did not have an issue with sufficiency of reagents. The problem mainly affected the County and day secondary schools. This often caused the students to conduct practicals in groups and some time the teachers would demonstrate practical to all the students. Chemistry teacher 1 reiterated that, "the school needs to provide sufficient reagents for practicals despite the challenge of insufficient apparatus because the students could be organized to share. There was also a challenge of insufficient reagents which most of the time led to setting groups of 4 to 5 students per experiment. The government through the school management should increase the budget allocated to reagents and apparatus in secondary schools to enhance scientific instructional practices.

Chemistry teachers and lab technicians were sufficient. They argued that with sufficient reagents and apparatus there might be a need for assistance from other chemistry teachers available in the school. Chemistry teacher 17 provided a profound comment that "Teachers are not the problem they are sufficient based on workload and sometimes the school did employ when necessary but the main challenge in a large class which is difficult to manage during practical sessions". This required more resources based on the space in the laboratory, apparatus and reagents which most of the time are not sufficient. These sentiments were shared by majority of the chemistry teachers that there was need to consider physical resources and the school should allocate more teachers through contract based employment.

4.7.3 Observation Results

Observation was carried out in twenty one selected secondary schools to assess resource availability. Mean and standard deviation was as shown in Table 4.12 below;

Table 4.12: Observation on Teaching Resources

	N	Mean	Std. Deviation
There are enough apparatus in the laboratory	21	3.2857	.56061
Chemical reagents are adequate for all the students	21	2.7143	.78376
The laboratory is adequate for the chemistry practical session.	21	1.8095	.67964

Findings indicated that apparatus were available but not adequate (mean of 3.2857). Variation was low (standard deviation of .56061). Chemistry reagents were somewhat not adequate for all the students (mean of 2.7143). Dispersion was low (standard deviation of .78376). Chemistry laboratory space was not adequate for the chemistry practical session (mean 1.8095). Variation was low in (standard deviation of .67964).

4.7.4 ANOVA Results

Teaching resource was tested against chemistry performance using ANOVA analysis. The following results were achieved.

Table 4.13: ANOVA on Teaching Resource and Chemistry Performance

			Sum of Squares	df	Mean Square	F	Sig.
Performance in chemistry practical * Resource in chemistry laboratory	Between Groups	(Combined)	22.726	4	5.682	8.617	.000
	Within Groups		211.657	321	.659		
	Total		234.383	326			

Table 4.13 reveals that teaching resources has significant effect on performance in chemistry ($F_{(P=5\%,\ 4,321)}$ =8.617, P = 0.000 <0.05). F- ratio between group variance to within group is 8.617, the value is closer to the mean hence variance is low. P< 0.05% the value is less than 5% meaning there is a significant relationship between variables and hence null hypothesis is rejected and alternative hypothesis accepted. Laboratory apparatus and reagents are crucial in chemistry practical this had an impact on chemistry performance.

4.7.5 Discussion on Teaching Resources and Chemistry Performance

The results indicated that chemistry apparatus were not enough during practical lessons mean of 2.65. The time allocation was found to be sufficient for chemistry practicals based on a mean of 3.08 but could not suit individual students to handle practicals at the same time. Chemistry teachers could not provide sufficient reagents during practical with an aggregate mean of 2.77. The inadequacy of apparatus and reagents coupled with shortage of time for individualized exposure to practical activities contributed to poor results in summative evaluation. Chemistry teachers and laboratory technicians were available but not enough to manage chemistry practicals with mean of 3.19. The main challenge was difficulty when handling large classes which stressed the available resources. The teachers were not able to assess the students as they proceeded with practicals with mean of 2.89. Majority of the laboratories were not equipped with apparatus and reagents for conducting practical (mean of 2.52).

ANOVA results indicated that teaching resources contributed significantly to performance in chemistry subject ($P<0.05$). The results revealed that the reagents, apparatus, teachers and laboratory technicians were available but not sufficient for conducting practical. Facilities were inadequate for all the students which led teachers resort to demonstration and practical activities done in groups or shifts. Small laboratory space was the main concern that made majority of teachers to use groups when conducting experiments. This inadequacy has contributed to students performing below average in national exams. This was similar to the observation made that there was no adequate space in the laboratories to accommodate students.

The findings of the study revealed that teaching resources contributed significantly to the performance in chemistry subject. When the students are exposed to practical activities more often, they acquire sufficient skills and broaden their understanding of chemistry content enabling them to perform better in summative evaluation. This is supported by Adalikwu and Iorkpilgh (2013) who noted that instructional materials (teaching aids) significantly affected performance of chemistry. The study was based on an experiment where the experimental group with sufficient instructional material performed better than those without instructional materials. Chen and Wei (2015) results critic the adaptation of curriculum material that it was affected by time constraints, external examinations and teacher’s pedagogical content knowledge. Therefore, there is need to balance the instructional methods employed against time availability and relevance to national examinations. Laboratory apparatus and reagents were not sufficient for practical activities. The inadequacies made the students not to do individualized experiments affecting their skills development necessary for evaluation. The finding led credence to the findings of Gutierrez (2014) who found that limitation of laboratory equipment, laboratory room management and learning environment are the main challenges that affected experimental based learning. Instructional materials generally enabled the students understand concepts in Chemistry and therefore leading to high academic achievement.

4.8 Chemistry Performance

Questionnaire, interview and observation schedule were interpreted on chemistry performance. The results were discussed and presented below.

4.8.1 Questionnaire Results

The study evaluated the performance of chemistry using frequency table that contain frequencies, percentages and mean. The values were obtained from Likert scale that was coded 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree as represented below in Table 4.14.

Table 4.14: Chemistry Performance

Questions	5(SA)	4(A)	3(N)	2 (D)	1 (SD)	Mean
Ability and competence of student affect performance in chemistry practical	98(30.1%)	102(31.3%)	60(18.3%)	52(16.0%)	14(4.3%)	3.67
Student perception to the subject has influenced performance in practical	79(24.2%)	140(42.9%)	61(18.8%)	40(12.3%)	6(1.8%)	3.76
Teacher instructional method determine the performance in chemistry practical	108(33.1%)	116(35.6%)	73(22.4%)	25(7.7%)	4(1.2%)	3.92
The resource availability in laboratory affects chemistry practical.	100(30.7%)	115(35.3%)	57(17.5%)	33(10.1%)	21(6.4%)	3.74
Students perform well in chemistry practicals	41(12.6%)	108(33.1%)	76(23.3%)	86(26.4%)	15(4.6%)	3.23

Table 4.14 shows results from students on chemistry performance. Ability and competence of the students were assessed on whether these affected performances in chemistry practicals. The response indicated that 98(30.1%) strongly agreed, 102(31.3%) agreed, 60(18.3%) neutral, 52(16.0%) disagreed and 14(4.3%) strongly disagreed. Student's ability and competence affected the performance in chemistry practical (mean of 3.67).

It was found that 79(24.2%) strongly agreed, 140(42.9%) agreed, 61(18.8%) neutral, 40(12.3%) disagreed and 6(1.8%) strongly disagreed that students' perception to the subject influenced performance in practicals. The result showed that students' perception to the subject had an effect to their performance (mean of 3.76).

On responses to if the teacher instructional methods determined performance in chemistry practicals 108(33.1%) strongly agreed, 116(35.6%) agreed, 73(22.4%) neutral, 25(7.7%) disagreed and 4(1.2%) strongly disagreed. It was established that teachers' instructional methods had significant influence on performance in chemistry practicals (mean of 3.92).

Majority of 100(30.7%) respondents strongly agreed, 115(35.3%) agreed, 57(17.5%) neutral, 33(10.1%) disagreed and 21(6.4%) strongly disagreed that resources in chemistry laboratory affected chemistry practicals. A significant number agreed that chemistry laboratory resources affected chemistry practicals (mean of 3.74).

Students performance in chemistry practical seem to be significant based on a total of 41(12.6%) strongly agreed, 108(33.1%) agreed, 76(23.3%) neutral, 86(26.4%) disagreed and 15(4.6%) strongly disagreed. Chemistry performance seemed to be lower in performance (mean of 3.23).

4.8.2 Observation Results

Observation schedule results on chemistry practical performance were summarized using mean and standard deviation. This was indicated in table 4.15 below.

Table 4.15: Observation on Chemistry Practical

	N	Mean	Std. Deviation
Students show observation and computation skills	21	3.1429	.79282
Students' participates in practical	21	2.9048	.70034
Student are prepared for practical	21	2.7619	.76842
The student showed knowledge awareness of chemistry	21	2.5238	.67964

Table 4.15 revealed that students showed low levels of observation and computation skills during practical (mean of 3.1429). Variation was low (standard deviation of .79282). The students participated in practical were below average (mean of 2.9048). Variation was low (standard deviation of .70034). Student had low preparedness for practicals (mean of 2.7619). The variation was low (standard deviation of .76842). Finally, students were low in chemistry knowledge during the practicals (mean of 2.5238). Variation was low (standard deviation of.67864).

4.8.3 Discussion on Chemistry Performance

Ability and competence of the student affected performance in chemistry practical to greater extent with mean of 3.67. The study also revealed that student's perception to the subject did affect the performance in practicals with mean of 3.76. In this study negative perception affected performance of students in practical activities and the entire subject. Teacher's instructional methods determined performance in chemistry practical to some extent mean of 3.92. Teachers using traditional methods found their students not doing well in summative evaluation. Resources in chemistry laboratory affected practicals mean of 3.74. In this study, resource inadequacy affected performance negatively. The performance in chemistry practical was found to be moderate with a mean of 3.23. There was average student participation in practical activities though their level of preparedness was low. The students were moderate in knowledge base in chemistry. These experiences combined contributed to low grades obtained by the students in their final examinations in chemistry subject.

4.9 Summary of the Chapter

From the study more female than male students were in the schools in the region. Chemistry subject has been made compulsory since it form the basis for placement into majority of careers in the Kenyan education system. Learner competencies, that is, observation, manipulation, problem solving and computation skills were low which had negative impact on performance in chemistry. Most students had negative attitude towards the subject. Teachers integrated lecture, demonstration and experimental methods for content delivery. Majority of laboratories were not well equipped with apparatus and reagents for conducting practicals.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter presents the conclusions and recommendations of the study in accordance with the findings in chapter four. The procedure for treating the summary, conclusions and recommendations was based on the relevant objectives. It also consists of suggestions for further study.

5.2 Conclusions

This is based on demographic results on gender of the students who participated on the study and the findings from research objectives which consisted of the main objective and the specific objectives.

5.2.1 Demographic Information

The study shows that there were more female than male students in the schools in the region. Equal opportunities were given to every child in secondary school education. Chemistry subject has been made compulsory and was done by all students in Form three classes.

5.2.2 Objective Summary

To evaluate the effect of observation, manipulation and computation competencies in chemistry practical on performance in chemistry

Learner competencies, that is, observation, manipulation, problem solving and computation skills were low which had negative impact on performance in chemistry. Entry mark affected performance in Chemistry to a small extent. Chemistry content was applied to a small extent when handling practicals. Most of the students were not able to follow instructions when handling practical and this affected their outcomes. Learner competencies significantly affected the performance in chemistry practicals.

To establish the effect of student perception to chemistry practical on performance in chemistry in secondary schools.

Students had negative attitude towards chemistry subject and the subject teacher hence affecting performance negatively. Students perceived chemistry practicals to be difficult to handle. Students were not well motivated and participated passively during practical sessions. Students' perception affected significantly performance in chemistry practicals.

To evaluate the influence of teaching methods in chemistry practical on performance in chemistry in secondary schools.

Some teachers used chemistry practical lessons for teaching theoretical part of chemistry denying the students opportunities for practical exposure. Teachers integrated lecture, demonstration and experimental methods for content delivery. Practicals were done as timetabled without teacher supervision and assessment was occasional. Laboratory activities were done individually or in groups depending on the nature of experiments and availability of apparatus. Instructional methods deployed were not motivating. Discussion method was utilized to a small extent and questions were asked occasionally. Teaching methods has significant influence on performance in chemistry practicals.

To determine the influence of teaching resources in chemistry practical on performance in chemistry in secondary schools.

Majority of laboratories were not well equipped with apparatus and reagents for conducting practicals and inadequate to accommodate large classes. Apparatus and reagents were provided for students to work in groups and occasionally in shifts. Time allocation for practical and theory was as per the time table although was inadequate for individualized activities. Chemistry teachers and laboratory technicians were somewhat sufficient in majority of the schools. County and day secondary schools had insufficient apparatus and reagents. Chemistry laboratory space was not adequate for practical activities. Teaching resources had significant influence on performance in chemistry practical and the entire subject.

5.3 Recommendations

From the study the following recommendations were drawn;

- Chemistry teachers should enable students develop observation, manipulation, problem-solving and computation skills through laboratory interactions to enhance performance.
- Students should develop positive attitude towards the subject, teacher and the school to enable them perform well in practical and the subject in general.
- There is need to integrate other methods like computer based learning and simulation to enhance content mastery and understanding of concepts in Chemistry.
- Teachers should utilize student centered participatory approaches more often like guided inquiry laboratory method, cooperative learning, computer assisted instruction than demonstration to master subject content.
- School management and teachers should provide sufficient apparatus and reagents for practical administration.

- The government should invest more in infrastructural development especially of science laboratories to meet the demands of increased number of students caused by the government policy of 100% transition.
- The government to deploy more chemistry teachers to day secondary schools to reduce the teacher to students' ratio and enhance classroom management.

5.4 Suggestion for Further Study

The study suggests that further studies be done on computer based instructional methods and its effect on performance in chemistry practicals.

Further studies be done on student motivation towards careers in chemistry and other science oriented courses.

The study suggests that further studies be done on the effect of culture on academic performance and student transition in Narok County.

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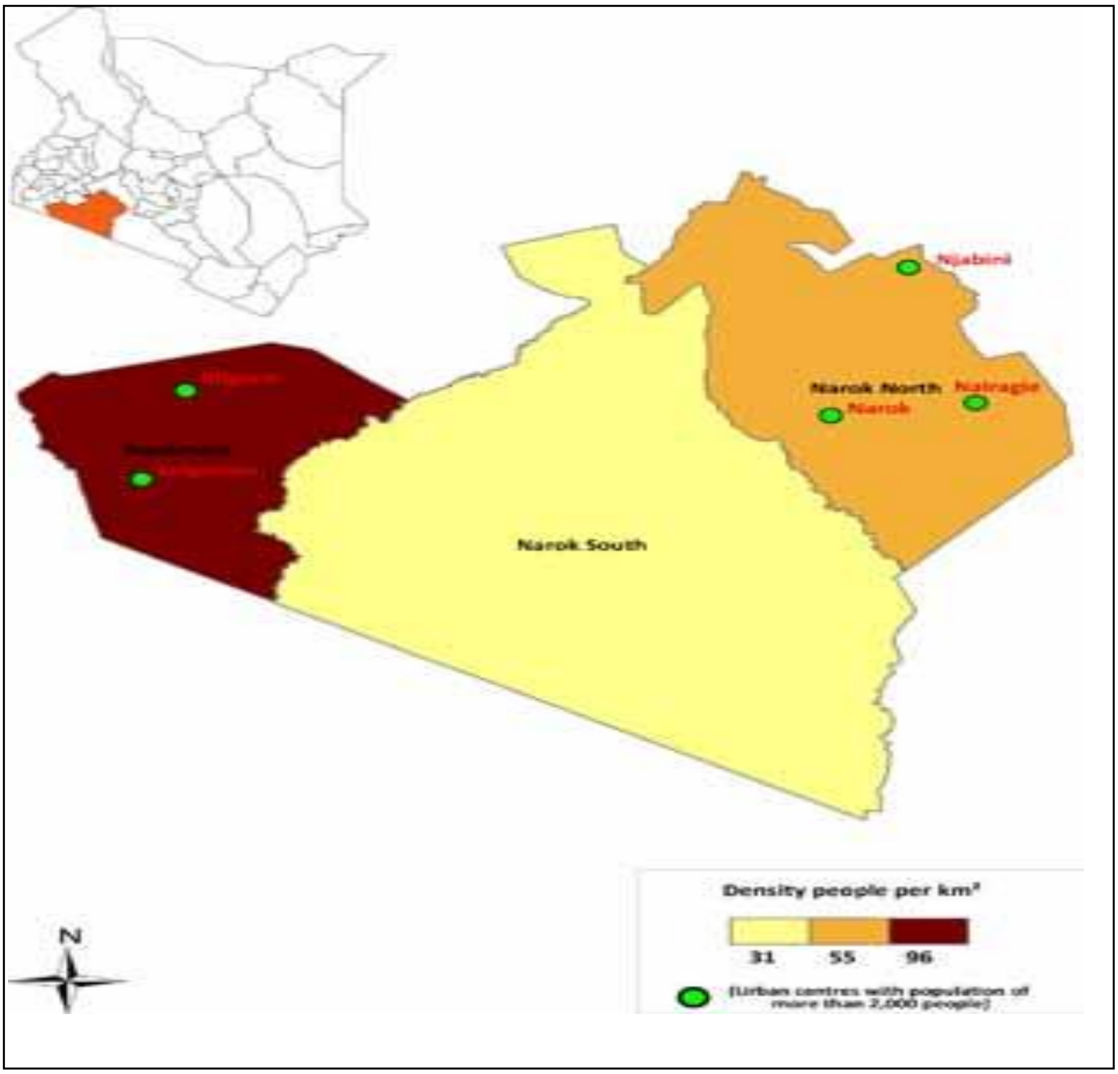
APPENDICES

APPENDIX I: MAP OF STUDY AREA



Source: County Integrated Development Plan (CIDP, 2013)

APPENDIX II: QUESTIONNAIRE FOR STUDENTS

Dear respondent,

The following is a questionnaire for research purpose please tick (✓) appropriately on the space provided and give relevant information as instructed.

Section A. Personal information

1. Gender: Male [ ] Female [ ]

2. Do you take chemistry subject Yes [ ] No [ ]

SECTION B: Learner Competencies and Chemistry Performance

The following is a list of statements regarding learner competencies on students' view. Tick (✓) according to how best you agree with the statements. The scale of 1-5 means; 5 – strongly agree, 4 – agree, 3 – undecided, 2 – disagree, 1 – strongly disagree

S/No.	Learner competencies in chemistry Practical	5	4	3	2	1
1.	We use observation skills in chemistry practical lesson.					
2.	We use manipulative skills in chemistry practical lesson					
3.	We apply chemistry knowledge to solve practical related problems.					
4.	Our entry marks affect the understanding of chemistry practical procedures.					
5.	We use computation skills in Chemistry practical lesson					
6.	We copy the work done by others and give out affecting competence in practical					
7.	Our ability and competence in chemistry practical affect chemistry subject score					

SECTION C: Students' Perception and Chemistry Performance

The following is a list of influences of perception of the student towards chemistry practical. Tick (✓) according to how best you agree with the statements. The scale of 1-5 means; 5 – strongly agree, 4 – agree, 3 – undecided, 2 – disagree, 1 – strongly disagree

S/No.	Statements regarding students' Perception to chemistry practical	5	4	3	2	1
1.	We like chemistry practical developing positive attitude in the subject					
2.	We have positive perception toward chemistry practical in the school					
3.	We like chemistry teachers especially during practical lessons					
4.	Perception towards our school and its performance affect chemistry practical.					
5.	Chemistry is easy subject to be understood					
6.	Chemistry practicals are easy to be done than other subjects					
7.	Positivity in chemistry practical contribute to the performance of the subject					

SECTION D: Teaching Methods and Chemistry Performance

The following is a list of statements regarding teaching methods in chemistry practical. Tick (✓) according to how best you agree with the statements. The scale of 1-5 means; 5 – strongly agree, 4 – agree, 3 – undecided, 2 – disagree, 1 – strongly disagree

S/No.	**Statements regarding teaching methods in chemistry practical**	**5**	**4**	**3**	**2**	**1**
1.	The teacher uses chemistry practical lessons to teach.					
2.	The teacher often conduct chemistry practical during practical lessons					
3.	The teacher demonstrates the process of titration as the learners observes					
4.	We carry out practical on our own without supervision of the teacher.					
5.	The teacher assess the learners as they proceed with chemistry practical					
6.	We are motivated by the teaching method deployed by the chemistry teacher during practical lessons					

SECTION E: Teaching Resources and Chemistry Performance

The following is a list of statements regarding the teaching resource in chemistry practical. Tick (✓) according to how best you agree with the statements. The scale of 1-5 means; 5 – strongly agree, 4 – agree, 3 – undecided, 2 – disagree, 1 – strongly disagree.

S/No.	**Statements regarding teaching resources in chemistry practical**	**5**	**4**	**3**	**2**	**1**
1.	Chemistry apparatus are sufficient during practical lessons.3					
2.	There is sufficient time allocation for chemistry practical lessons					
3.	Chemistry teachers provided sufficient reagents during practical lessons					
4.	There are sufficient chemistry teachers and lab technicians to administer chemistry practicals					
5.	The teachers assess the learners as they proceed with chemistry practical					
6.	Laboratory is well equipped with chemistry reagents and apparatus for conducting practical.					

SECTION E: Chemistry Performance

The following is a list of statements regarding the performance in chemistry practical. Tick (✓) according to how best you agree with the statements. The scale of 1-5 means; 5 – strongly agree, 4 – agree, 3 – undecided, 2 – disagree, 1 – strongly disagree

S/No.	**Statements regarding performance in chemistry practical**	**5**	**4**	**3**	**2**	**1**
1.	Our ability and competence affect performance in chemistry practical					
2.	Our perception towards the subject has influence on performance in practical					
3.	Teacher instructional method determine performance in chemistry practical					
4.	The resource availability in chemistry laboratory affect chemistry practical performance.					
5.	We perform well in chemistry practicals					

Thank you for your response.

APPENDIX III: INTERVIEW SCHEDULE FOR CHEMISTRY TEACHER

Section A: Learner competencies in chemistry practical on performance in chemistry in Secondary Schools

1. In your opinion are the students competent in observation skills?

2. Are the students able to manipulate apparatus during practical session?

Yes [ ] No [ ]

3. Explain whether the students are able to compute practical data to solve problems?

4. Is the performance of students in practical activities affected by their entry behaviour? Explain.

Section B: Students perception in chemistry practical on performance in chemistry in Secondary Schools

5. What is the attitude of your students towards chemistry?

6. How do the students perceive chemistry practical?

7. What is their perception towards the chemistry teacher?

8. What perception do they have towards the school?

Section C: Teaching methods in chemistry practical on performance in chemistry in Secondary Schools

9. Do you use lecture method to instruct practical content?

10. How often do you carry out practicals in chemistry?

11. Do you demonstrate practical activities? If yes, comment.

12. Do your students handle practicals individually or in groups? Explain the selection above.

Section D: Teaching resources in chemistry practical on performance in chemistry in Secondary Schools

13. Are practical apparatus available for chemistry practical? If yes, are they enough?

14. Are chemistry practical in class timetable allocated sufficient time? If no, do you use extra-time outside the time table?

15. Are there sufficient reagents for chemistry practical? If not how do you handle practical lessons?

16. Are there sufficient chemistry teachers and lab technicians to administer practical effectively? Comment.

Thank you for your participation

APPENDIX IV: OBSERVATION CHECKLIST

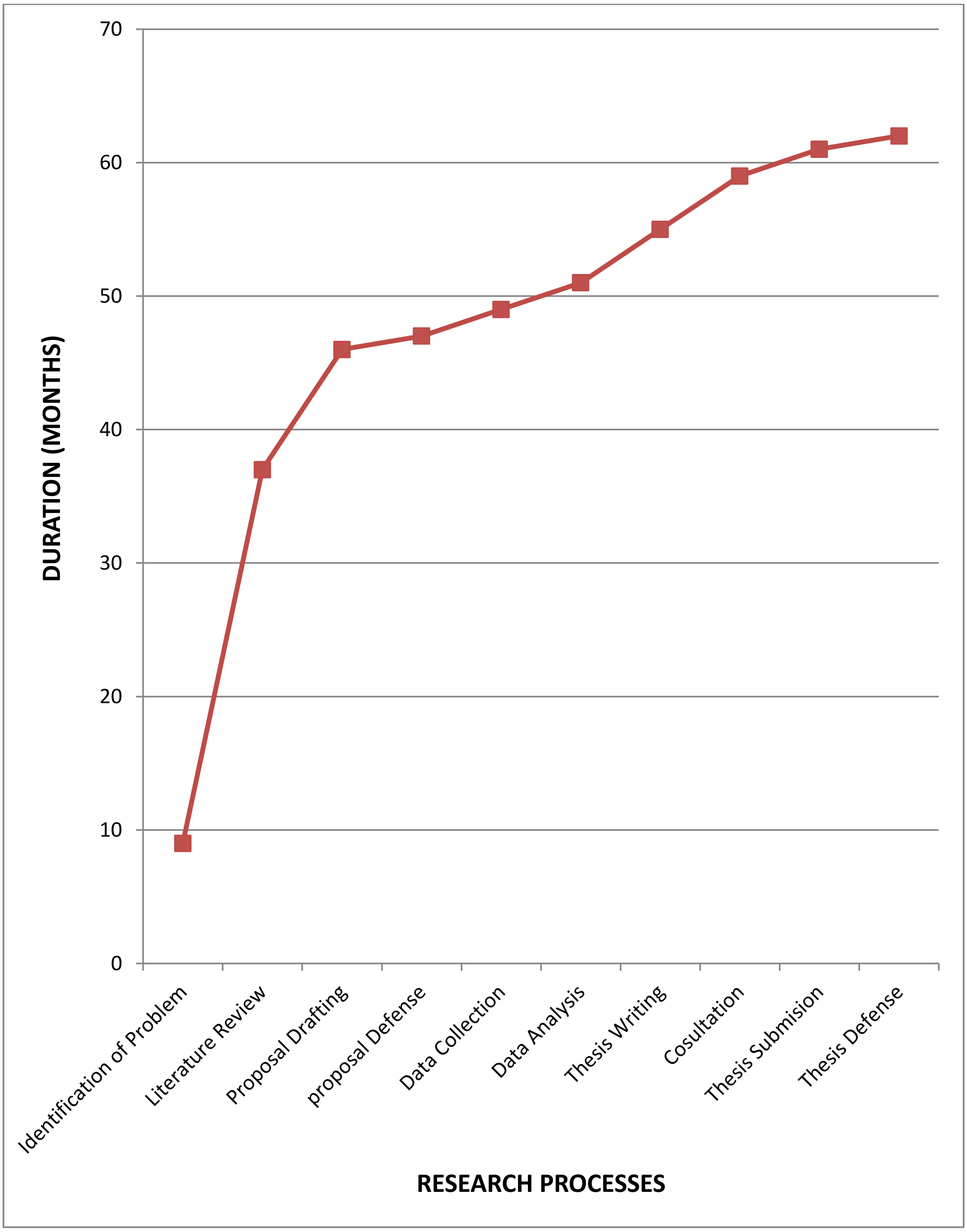
Tick appropriately(√) from the observations made during the practical session.

Observation	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
SC1: Students have strong ability to make observations					
SC2: Students are able to follow instructions in chemistry practical					
SC3: Students are knowledgeable in practical sessions					
SP1: Students participates actively in practical session					
SP2: Students are motivated in chemistry practical sessions					
SP3: Students enjoy chemistry practical activities					
TM1: Students are allowed to discuss and ask questions during practical session					
TM2: Students have high practical skill					
TM3: Teachers assess the practical done by the students					
TR1: There are enough apparatus in the laboratory					
TR2: Chemical reagents are adequate for all the students					
TR3: The chemistry laboratory is adequate for the chemistry practical session.					
P1: Students show observation and computation skills					
P2: Students’ participates in class					

P3: Students are prepared to handle practical					
P4: Students showed knowledge awareness of chemistry					

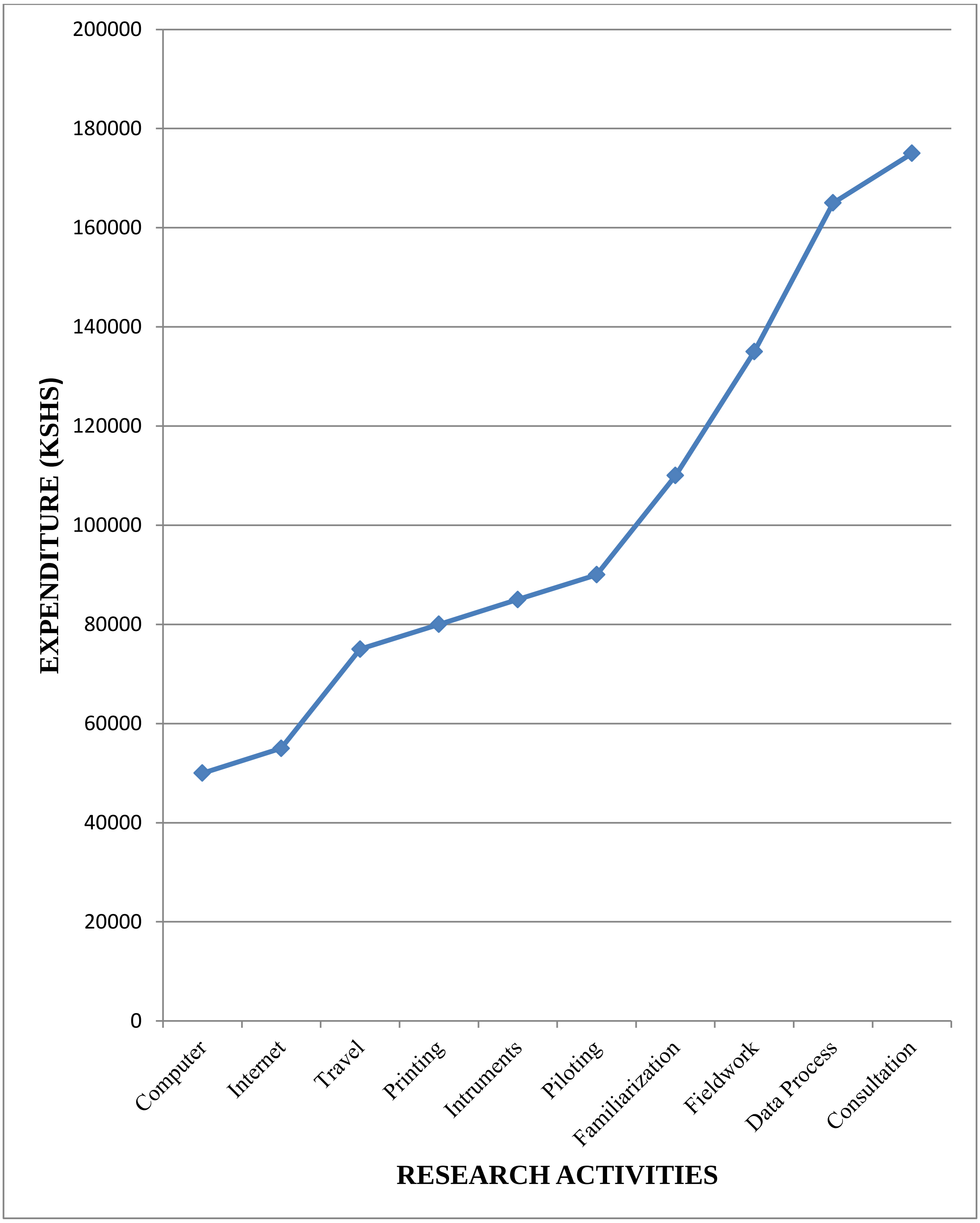
APPENDIX V: WORK SCHEDULE

The duration of the research process took sixty two months. The activities undertaken were shown on the graph below.



APPENDIX VI: RESEARCH BUDGET

This shows the estimated cost or the expenditure incurred during the actual process of research. It was illustrated graphically below.



APPENDIX VII: RESEARCH PERMIT FROM SCHOOL OF EDUCATON

P.O. Box 1125-30100, ELDORET, Kenya
Tel: 053-2063111/8 Ext.2032
Fax No. 20-2141257
Email: soe@uoeld.co.ke
www.uoeld.ac.ke

University of Eldoret
flame of knowledge and innovation

UNIVERSITY OF ELDORET

SCHOOL OF EDUCATION
CENTRE FOR TEACHER EDUCATION

Thursday, 15TH August , 2019

Ref: UOE/B/CTE/PGC/033/Vol.1

The Executive Secretary
National Council for Science & Technology
P.O. Box 30623 - 00100
NAIROBI

Dear Sir/Madam,

SUBJECT: **RESEARCH PERMIT FOR:**
RONOH OBADIAH CHERUIYOT EDU/PhD/SE/002/14

This is to confirm that the above named Post Graduate Student has completed Course Work and has successfully defended his thesis proposal.

He is currently preparing for a Field Research Work on his thesis entitled: *Evaluation of Competencies, Perception and Resources in Practicals on Performance of Chemistry in Narok County Secondary Schools, Kenya.*

Any assistance accorded to him to facilitate successful conduct of the research and the publication will be highly appreciated.

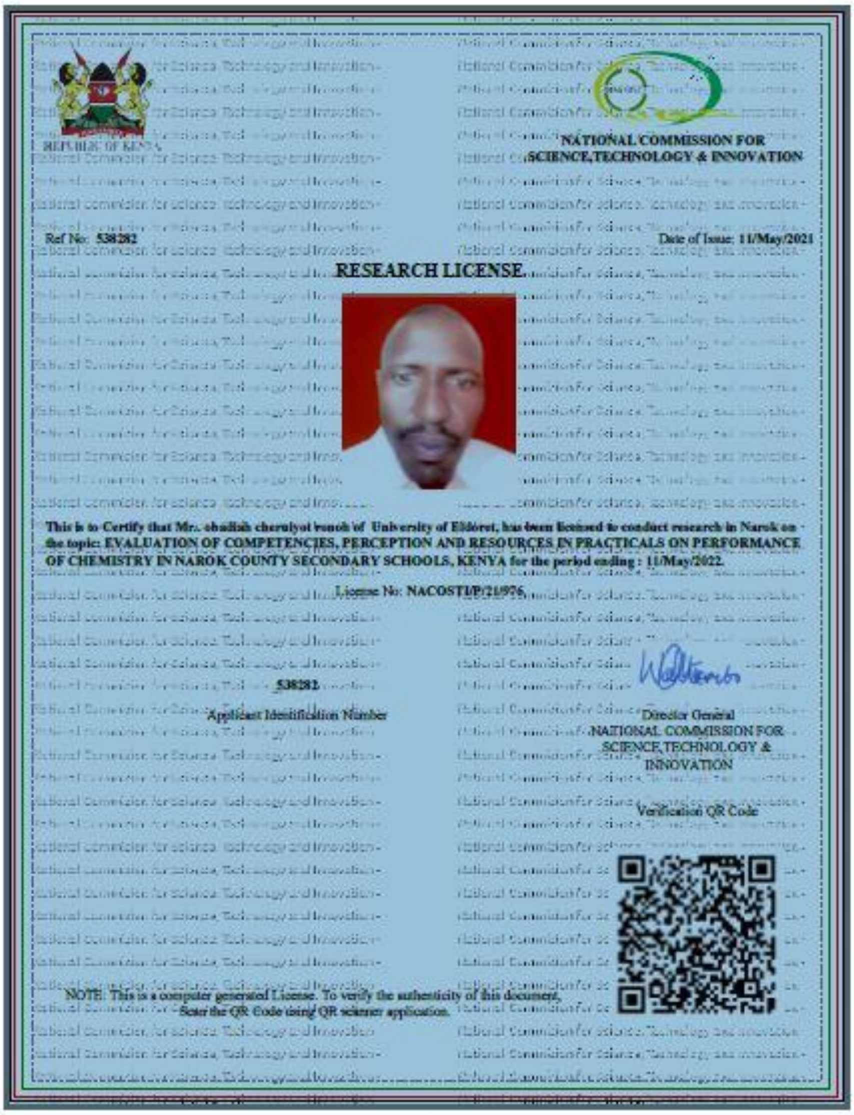
Yours Faithfully,

HEAD
Centre for Teacher Education
UNIVERSITY OF ELDORET
MAIN CAMPUS

R.M. AMINGA
HEAD, CENTRE FOR TEACHER EDUCATION

University of Eldoret is ISO 9001: 2015 Certified:

APPENDIX VIII: NACOSTI PERMIT (CORRECTED UNIVERSITY OF ELDORET)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Ref No: 538282

Date of Issue: 11/May/2021

RESEARCH LICENSE

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REPUBLIC OF KENYA

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Ref No: 538282

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APPENDIX X: RESEARCH PERMIT FROM COUNTY DIRECTOR OF EDUCATION, NAROK

REPUBLIC OF KENYA

MINISTRY OF EDUCATION

State Department of Early Learning and Basic Education

COUNTY DIRECTOR OF EDUCATION
NAROK COUNTY
P.O BOX 18
NAROK

FAX NO. 050-22391
When replying please quote;

Ref. CDE/NRK/RES/VOL1/199

DATE: 12TH SEPTEMBER. 2019

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION – OBADIAH RONOH.

The above mentioned is a student of University of Eldoret.
He has been authorized to carry out research on "***Evaluation of Competencies, Perception and Resources in Practicals on Performance of Chemistry in Narok County Secondary Schools, Kenya*** for the period ending ***19th August, 2020***.

Please accord him necessary assistance.

PHILIPH WAMBUA
COUNTY DIRECTOR OF EDUCATION
NAROK

C.C.

- The County Commissioner – Narok
- Obadiah Ronoh

APPENDIX XI: RESEARCH AUTHORIZATION FROM COUNTY COMMISSIONER

Telegram: "COUNTY", Narok County
Telephone: Narok [050] 22305/22435
Fax: [050] 22588/22305/22127
If calling or telephoning ask for the undersigned.
When replying please quote;

County Commissioner
Narok County
P O Box 4-20500
Narok

RE: SR.ADM.15/6/VOL.II/18

11TH Sept, 2019

All Deputy County Commisioners
Narok County

RE: RESEARCH AUTHORIZATION : OBADIAH RONOH

Mr. Obadiah Ronoh of University of Eldoret, has been authorized to carry out research on **"Evaluation of Competencies, Perception and Resources in Practicals on Performance of Chemistry in Narok County Secondary Schools, Kenya."** In Narok County for the period ending 19th August, 2020.

Kindly accord him necessary assistance.

MUTUKU MWENGA HSC ndc 'K'

FOR COUNTY COMMISSIONER

NAROK COUNTY

C.C.

Obadiah Ronoh

APPENDIX XII: SIMILARITY REPORT

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