AN INVESTIGATION OF FACTORS INFLUENCING STUDENTS' LOW ACHIEVEMENT IN CHEMISTRY IN PUBLIC SECONDARY SCHOOLS IN ATHI RIVER SUB- COUNTY, MACHAKOS COUNTY, KENYA

BY

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DECLARATION

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

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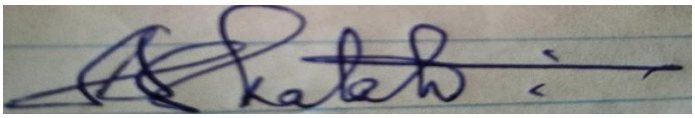
Signature: 

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DEDICATION

This Thesis is dedicated to my family, my wife Idah, my son Victor and my daughter Patience. I truly thank them for their understanding, unconditional love, patience and consistent support throughout the time I was carrying out research and writing the thesis.

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First and foremost, I thank God the Almighty because without His will, I would have never found the right path to academic excellence. His mercy has been with me throughout my life, and throughout this thesis. The thesis owes its completion to the help, support, and inspiration I have received throughout my academic journey. Secondly, I express my special gratitude to my thesis supervisors, Dr. Priscilla Gachigi and Dr. Jackson Ndung'u Mwangi for their professional guidance, timely evaluation and technical advice on the best approach to follow throughout the period of the research project writing. Besides, I wish to offer special appreciation to the KCA University management for granting me the opportunity to undertake my master's degree at the institution. I am truly and expressly grateful to the faculty, staff and fellow students within the School of Education, Arts and Social Sciences for all the resourceful and emotional support they extended. Undertaking this master's program, and our interactions, have remained a constant source of encouragement and enthusiasm, making the writing process not only a scholarly undertaking but also an enjoyable experience.

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ABBREVIATIONS AND ACRONYMS

BoM: Board of Management

CBC: Competency based Curriculum.

CDF: Constituency Development Fund

GDP: Gross Domestic Product

GNP: Gross National Product

GoK: Government of Kenya

ICT: Information Communication and Technology

INSET: In-Service Training

KCPE: Kenya Certificate of Primary Education

KCSE: Kenya certificate of Secondary Education

KICD: Kenya Institute of Curriculum Development

KNEC: Kenya National Examination Council

MoE: Ministry of Education

NACOSTI: National Commission for Science, Technology and Innovation

NEMIS: National Education Management Information System

NGOs: Non-Governmental Organization

PA: Parents Association

SCDE: Sub County Director of Education

SMASSE: Strengthening Mathematics and Sciences in Secondary Education

TSC: Teachers Service Commission

OPERATIONALIZATION OF TERMS

Chemistry	It is one of the science subjects done in secondary school. It is concerned with the study of composition, properties and reaction of matter under different physical conditions.
Performance	Refers to the mean scores as obtained by students in KCSE examination
Public school	This is a school formally supported by government especially in terms of teachers' employment.
Student's perception	It is a way of thinking or feeling about something or someone that a learner has, usually mirrored in how they behave in response to that item, circumstance, or person. It can also refer to a learnt, emotionally developed propensity to consistently react favorably or unfavorably to a certain person, thing, or circumstance.
Teaching/learning resource	These are materials used by teachers and learners and which aid in acquiring of knowledge, attitude and skills during teaching and learning process

ABSTRACT

Chemistry is a crucial scientific discipline for any nation and is essential for various curricula, including medicine, pharmacy, architecture, and dental care, among others. Despite Kenya's efforts to advance and modernize academia, chemistry performance in public secondary schools has remained low. The aim of this study was to identify factors influencing students' low achievement in chemistry in Athi River Sub-County, Machakos County, Kenya. The theory that guided the study is the production function theory. The study had four objectives including; to establish the students factors that influence the performance in chemistry in KCSE in public secondary schools in Athi River Sub County, Machakos County, Kenya, to identify the teacher's factors that influence students' performance in chemistry in public secondary schools in Athi River sub county, Machakos County Kenya, to find out whether the performance of chemistry is influenced by resource access in public secondary schools in Athi River sub county, Machakos county Kenya, and to identify the methods used by teachers in public secondary schools, to raise chemistry performance levels in public secondary schools in Athi River sub county, Machakos County, Kenya. A total of 168 respondents participated in the study, including 14 principals, 14 teachers of chemistry, and 140 Form 4 students, with 10 students selected from each school. The sample selection utilized stratified sampling. Data was collected through questionnaires to obtain feedback from the respondents. Data was analyzed using Microsoft Excel. Findings were presented using frequency tables, pie charts and bar graphs. The study focused on production integrals, where various inputs from students' factors, teachers' factors, and school environment interact to produce the output of student accomplishment. The study was conducted in Athi River Sub County, where chemistry achievement among students has consistently been low. The findings indicated a positive perception of using ICT materials and methods for education and learning, as well as the recognition of the benefits of ICT in education. However, some students felt they needed further instruction and skills development to utilize ICT effectively. Interestingly, despite being interested in careers that require chemistry knowledge, students displayed a negative attitude towards the subject. Inadequate reference textbooks in the library also hindered individual revision by students. To address these issues, the study recommended providing more instructional resources, such as a variety of chemistry textbooks in the libraries. Schools should also invest in adequate resources and infrastructure to facilitate practical learning experiences and enhance students' understanding and performance. Besides, the study recommended that schools should work to improve students' attitudes towards chemistry through methods such as organizing talks to dispel negative perceptions, creating a positive learning environment and arranging visits for real-world inspiration to learners. The study recommended further research on, why teachers prefer demonstration over individual practicals in schools with equipped laboratories, impact of teachers' intrinsic motivation on performance of chemistry in public secondary schools and an assessment of teacher student ratio on performance of all examinable subjects in both private and public secondary schools in Kenya.

CHAPTER ONE

1.1 Introduction to the Study

This chapter outlines background of study, statement of the problem, purpose of the study, objective of the study, research questions, and assumptions of the study, significance of the study and scope and limitation of the study**.**

1.2 Background Information

Globally, the insufficient availability of essential resources like properly equipped laboratories, qualified instructors, and adequate teaching materials has been identified as a significant cause of underperformance in chemistry within public secondary schools worldwide. As a consequence, the learning environment becomes unfavorable, hindering students' ability to comprehend chemistry concepts effectively. In many of these schools, students mostly rely on theoretical learning, lacking the necessary practical experiences that are vital for a comprehensive understanding of chemistry (Winberg, 2017).

In the United Kingdom, several factors contribute to students' low achievement in chemistry in public secondary schools. One of the significant challenges is the shortage of qualified teachers. According to the Royal Society of Chemistry, about a quarter of UK secondary schools have difficulty recruiting science teachers, and this shortage is particularly acute in chemistry. The lack of qualified teachers results in large class sizes and limited practical work, which can affect students' engagement and understanding of chemistry concepts (Sintema, 2020).

In the United States, one of the factors contributing to low achievement in chemistry is the lack of interest in science. According to a study by the National Science Foundation, only 36% of high school students in the US are interested in pursuing careers in science and technology. This lack of interest has led to disengagement and poor performance in chemistry. Additionally, the US education system is highly standardized, which do not allow for individualized instruction and hinders students' learning (Ogunode, and Aiyedun, 2020).

In Asia, one of the significant factors contributing to low achievement in chemistry is the high-stress levels experienced by students. Students in countries like China, South Korea, and Japan face intense pressure to succeed academically, and this has led to mental health issues and disengagement from subjects like chemistry (Stoet, and Geary 2018).

In South Africa, one of the significant factors contributing to low achievement in chemistry is the lack of resources. Many public secondary schools in South Africa do not have access to adequate equipment, laboratories, or textbooks, which can limit students' ability to learn and perform well in chemistry. Additionally, the socio-economic status of students has also influenced their performance, as students from disadvantaged backgrounds may not have access to the same resources and opportunities as their more affluent peers (Stoet, *et al.* 2018) In Nigeria, low achievement in chemistry has been attributed to the lack of qualified teachers and inadequate infrastructure. Many public secondary schools in Nigeria do not have qualified teachers of chemistry, and this can lead to a lack of understanding of basic concepts. Additionally, the lack of laboratories and equipment can limit students' ability to conduct practical work and deepen their understanding of chemistry concepts (Jensen, & Cross, 2021). Among the key contributors to economic progress, increased income, the accessibility of skilled labor, a drop in population increase, high life expectancy, better health outcomes, and low crime rates in Kenya has been recognized as schooling. Ikharehon (2020) contends that no nation on earth ignores the constant enhancement of its people, communities, and other institutions of national development through strategic alignment of people, knowledge base, training, and competences.

The cornerstone of fairness and equality and an equal share of wealth, as per Sombat, K. (2021), is learning. Schooling also holds the key to technical and scientific growth and competence. That both state and the citizens of Kenya has made significant investments in raising educational standards in order to fulfill the potential of school and to carry out Vision 2030 and the Millennium Development Goals related to learning. Even though the causative link connecting learning and development in Kenya is not as strong as it is in more developed countries, there is enough data to draw the conclusion that access to and availability of high-quality education promotes both economic and social growth.

The GoK has continued to make significant investments in formal education because of this. For example, Kenya's state educational spending as a percentage of GDP climbed from 16.65% in 2015 to 26% in the 2019–2020 fiscal years. In the fiscal year 2021–2022, it increased even more, hitting 29.4%. Kenya devotes a lot more money on levels comparable to its overall government expenditure and GNP (GNP). Table 1.1 displays the percentage of government spending in Kenyan on educational at differing stages.

Table 1.1: The percentage of government spending on education in different levels in Kenya

Level of Education	% of fund allocation (2020/2022)
Primary Education	16
Secondary Education	18.72
Tertiary Education	15.08

Source: World Bank Group

In accordance with the previous table, primary and secondary education receive the biggest percentage of funding. The Kenyan government recognized the significance of science education and related it to the attainment of the Vision 2030 goals for technical, economic, and technical progress (Government of Kenya, 2020). The government believes that one of the primary educational goals is to provide learners with scientific knowledge and process skills for industrial and technical development in order to achieve Vision 2030. It is envisaged that acquiring this knowledge and process abilities will assist the country in fulfill Vision 2030 and increase its technical competitiveness on the global market.

Hitherto, innovative teaching instruction that would result in the development of skills and modern science calls for the supply of both physical and trained human resources, as well as an adequate curriculum. In terms of the curriculum, the 8-4-4 scientific curriculum in Kenya mandates that all secondary school students must take at least two science classes as they advance to form three, regardless of their area of concentration. Science is required for all students up till form two of the curriculum (KICD, 2018). In light of this, taking a scientific course is required. The syllabus also suggests allocating a double session every week to laboratory-based activities in each science subject to help students enhance their understanding of the scientific method.

This one is predicated on the idea that routine laboratory use does help students develop both scientific process abilities and a conceptual grasp of science. The KICD-created Competency-based Curriculum (CBC), which was given department of instruction approval, was started in 2017. The 8.4.4 systems is being replaced by the educational system. Via CBC, students are exposed to a method of instruction that requires them to apply logic, common sense, and

imagination to find solutions. The Competency Based Curriculum places a strong emphasis on science, engineering, and mathematics (STEM).

Most significantly, the Ministry of Education (MoE) has acknowledged the importance of the science laboratory in the science curriculum because its utilization helps students attain the state's instructional goals (Government of Kenya, 2018). In order to create an atmosphere suited to good science teaching and learning, the government set up labs and equipped institutions with scientific instruments (Waititu & Orado, 2019).

The government has set up in-service training (INSET) in alongside offering physical resources to improve the teaching of mathematics and science in high schools (SMASSE) (Nui & Wahome, 2017; Waititu & Orado, 2019). The INSET is founded on a series of surveys that revealed that it was necessary to alter educators' mindsets about classroom instruction, offer them effective teaching strategies, plus strengthen existing subject-matter expertise. In in order to enhance student achievement, this was thought that just by concentrating on these three factors, the teachers would be able to control the science teaching environment (classroom and laboratory). The primary goal of the INSETs is to education is a life to use "hands-on" and "minds-on" teaching strategies (Nui & Wahome, 2017).

Such strategies call on students to fully involve in learning programs. The scientific classroom will unavoidably be used in these instructional methods. A national ICT policy was adopted by the Kenyan administration in January 2017. This came after numerous previous attempts that were unsuccessful (Waema, 2017; Kariuki, 2019). Infrastructure investment, involvement of participants in the growth of human resources, and a suitable regulatory and legislative structure serve as the policy's four guiding principles. The GoK, through MoE, coordinates, supervises, and mobilizes the main participants in the ICT in education sector. (2020) Farrel Capacity has been supplied to schools, mostly secondary level, through a variety of initiatives. They include programs backed by parents, the government, non-profit organizations (NGOs) or even other development organizations, and the finance industry. (2020) Farrel NEMIS, Computers for Education, and the Microsoft Partners in Learning initiative stand out among these.

The Kenya Economic Stimulus Program (ESP) was also launched by the Kenyan government to promote economic growth. The post-election violence of 2020–2018 led the economy to

shrink, and as a result, the rate of economic development dropped from 7.1% in 2020 to 1.7% in 2019. As a result, the Kenyan economy entered a previous recession. A total sum of 22 billion Kenyan shillings was distributed among the 210 districts. Within other endeavors, this money will be used to construct classrooms, agricultural marketplaces, and the health industry. Within additional items, every district needed to upgrade the two main schools, create a secondary school that would act as an exceptional center, hire an extra 10500 primary school teachers, and engage 2100 secondary school teachers. Across the globe, there have been periodic declines in scientific competence in Tanzanian educational establishments as well as those across Africa and the world. Jidamwa (2020).

According to expatriates' assessment ratings carried out within pre-established philosophical and empirical frameworks, scientific literacy in Europe (2018) indicates a decrease in the general level of academic curriculum ability across European Members. The objectives of all (GOK actions) and projects are to guarantee that science students gain the knowledge and abilities required to create the technological society that Kenya's vision 2030 envisions. As a result, the worldwide community has placed a high emphasis on science instruction. In the context of science education, chemistry is acknowledged as a crucial science topic, and its importance for the rapid development of science and technology in any nation has been extensively documented.

Chemical structure is established as an important subject amongst scientific method as well as other scientific programs in the Nigerian educational system as a result of the attention given to Chemistry in the growth of both individuals and the country. It has long been a requirement for most science-oriented courses at tertiary institutions, hence competent instruction in it is necessary. Edmwonyi-out (2018).Chemistry instruction should be goal-oriented and student-centered, and these goals can only be realized whenever the students are prepared, the teachers are in good spirits, and the students are being taught utilizing the right equipment and techniques. Students must take an active role in the learning process as they constantly prepare, test, speculate, and develop their own.

This information is able to be efficacy and performance significant, therefore beneficial to people by customizing it. Learners must actually create their own consciousness and purpose when studying science. Children still do poorly in chemistry and other disciplines, despite chemistry's prominence in our education systems and scientists' best attempts to raise

achievement levels. This is evident from applicants' ongoing poor performance on science questions in national exams, as seen in Table 1.2's KNEC science scores for the years 2020, 2021, and 2022.

Table 1.2: KCSE- Science analysis for the Years 2020-2022

		YEAR		
		2020	2021	2022
SUBJECT		Mean (%)	Mean (%)	Mean (%)
Biology		27	34.95	29.43
Chemistry		19.5	18.5	16.61
Physics		23.23	29.17	34.30

Source: KNEC Reports 2020, 2021 and 2022

According to the table 1.2 above, chemistry has had the worst score from among the three scientific disciplines within the three years in consideration. Which suggests that it's challenging to forecast how students will perform in Chemistry in the coming years. This will further exclude students who want to enroll in science-related courses that demand chemistry proficiency as a required prerequisite. One of the sub counties recognized for low performance over the previous few years, particularly in the curriculum, is Athi River Sub County. As shown in table 1.3, the achievement in chemistry over the past three years can be compared on the KCSE Exam performance in the Athi River Sub County.

Table 1.3; Science performance in KCSE exam (2020 – 2022), Athi River Sub County

Year	2020		2021		2022	
	M.S.	M.G	M.S.	M.G.	M.S.	M.G.
Biology	2.99	D	3.32	D+	2.99	D+
Physics	3.5	D+	2.92	D	3.70	D+
Chemistry	2.46	D-	2.41	D-	2.57	D

Key:

M.S. = Mean Score, M.G. = Mean

Source: Extracted from Athi River Sub County KCSE result analysis, 2020, 2021 and 2022.

According to table 1.3 above, Chemistry is the least well-done of the three sciences offered in Athi River Sub County. Almost majority of the students in the Sub County receive low grades in chemistry that suggests that they're unable to enroll in scientific fields that need chemistry expertise, such as medical courses and pharmacy; according to the mean scores and mean grades in chemistry. Funds devoted to the Chemistry subject will remain to be squandered, and the Sub County will lose out on prospective competent personnel in those scientific programs that require chemistry abilities and expertise if the reason of such low achievement is not found and subsequently rectified. Although the state, families, and private industry have made significant educational expenditures, the quality of science achievement has remained to be subpar, with chemistry ranking far behind the other disciplines.

There is a persistent issue with the performance of students in Chemistry within the Athi River Sub County, as evidenced by the KCSE exam results from 2020 to 2022. During this three-year period, students' scores in Chemistry have consistently lagged behind those in other science subjects, namely Biology and Physics. In 2020, the mean score (M.S.) for Chemistry was 2.46, which is equivalent to a grade of D-. In 2021, the mean score slightly decreased to 2.41, maintaining the D- grade level. Although there was a slight improvement in 2022 with a mean score of 2.57 (still at a D grade), the issue remains glaring.

The problem in Chemistry subject performance is attributed to various factors such as a lack of adequate resources, including well-equipped laboratories and qualified teachers, limited access to quality study materials, and a potential gap in teaching methodologies (Musyoki, 2015). Additionally, it is crucial to investigate whether there are specific challenges faced by students in Chemistry that need addressing, whether it be a lack of interest, difficulty in grasping concepts, or other factors affecting their performance.

Efforts should be made to analyze and address the root causes of this problem to ensure that students in Athi River Sub County can achieve better results in Chemistry and excel in their science education overall.

1.3 Statement of the Problem

The current problem of persistent low achievement in chemistry in public secondary schools has garnered significant attention in the existing literature. This issue is multifaceted, with a multitude of factors coming into play. These factors encompass various student-related challenges, teacher-related aspects, resource accessibility limitations, and the teaching methodologies employed by educators, as highlighted by Okoth (2018). However, the need for further research becomes evident when considering the unique context of Athi River Sub County, Machakos County, where students consistently underperform in chemistry examinations.

Okoth (2018) underscores the importance of these contributing factors to low achievement in chemistry, but there exists a critical research gap that necessitates a localized investigation. This research should specifically address the challenges faced by students in Athi River Sub County, offering insights distinct from those found in broader studies. While Mulandi (2021) observed poor science performance, including chemistry, in Kirinyaga West sub-county, their study does not delve into the unique factors at play in Athi River Sub County. Similarly, Musyoki's (2015) findings in the Mwala District of Machakos emphasize instructor-related factors and their impact on KCSE exam results. However, there remains a gap in linking these findings to the Athi River Sub County context. Furthermore, Mabula's (2020) mention of sub-Saharan nations' poor performance in science does not provide the specific insights needed to understand the challenges faced by students in Athi River Sub County. Consequently, a research gap is evident in this context, as no prior studies have adequately explored the intricate factors contributing to persistently low achievement in Chemistry among students in Athi River Sub County, Machakos County.

Given Kenya's ambitious Vision 2030, which heavily relies on cultivating a well-educated workforce, including professionals in fields such as medicine, engineering, nursing, chemistry education, and pharmacy, it becomes imperative to address the issues afflicting Chemistry education in Athi River Sub County. Neglecting this concern could lead to a potential shortage of these critical professionals in the future. Therefore, this study aims to bridge the existing research gap by identifying and comprehensively analyzing the factors influencing low achievement in Chemistry among students in this specific region. This research endeavor

becomes all the more crucial, despite ongoing efforts by stakeholders to improve performance through resource provision and other initiatives.

1.4 Purpose of the Study

The investigation of the causes of students' poor performance in chemistry in public secondary schools in Athi River Sub County, Machakos County, Kenya, and the formulation of recommendations were the main objectives of the study.

1.5 Objectives of the study

The study was based on the following objectives.

i. To establish the students' factors that influence the performance in chemistry in KCSE in public secondary schools in Athi River Sub County, Machakos County, Kenya
ii. To identify the teachers' factors that influence students' performance in chemistry in public secondary schools in Athi River Sub County, Machakos County, Kenya.
iii. To find out whether the performance of Chemistry is influenced by resource access in public secondary schools in Athi River Sub County, Machakos, Kenya.
iv. To identify the methods used by teachers in public secondary schools, to raise chemistry performance levels in public secondary schools in Athi River Sub County, Machakos County, Kenya.

1.6 Research questions

The researcher developed four study questions based on the aforementioned objectives.

i. What students' factors influence the performance in chemistry in public secondary schools in Athi River Sub County, Machakos County, Kenya?
ii. What teachers' factors influence students' performance in Chemistry in public secondary schools in Athi River Sub County, Machakos County, Kenya?
iii. Does the performance of Chemistry depend on the resource access in public secondary schools in Athi River Sub County, Machakos County, Kenya?
iv. What methods do teachers in public secondary schools use to raise chemistry performance levels in public secondary schools in Athi River Sub County, Machakos County, Kenya?

1.7 Significance of the Study

In Athi River Sub County, Machakos County, Kenya, the persistently low performance of students in the chemistry subject has been a pressing concern. To address this issue and uncover the underlying reasons, a comprehensive study was conducted. The findings of this study have significant implications for various stakeholders.

First and foremost, the students themselves pursuing science as their final assessable field will benefit from understanding the root causes of their struggles in chemistry. By identifying these issues, students can take proactive steps to improve their performance and seek additional support where needed. Chemistry professors, who play a pivotal role in shaping students' understanding of the subject, will also find these results valuable. It can inform their teaching methods and curriculum design, tailoring them to address the specific challenges faced by students in the Sub County.

Administrators of educational establishments, including schools and colleges in Athi River, will gain insights into the factors contributing to mediocre performance in chemistry. Armed with this knowledge, they can implement targeted interventions to improve the learning environment and support systems within their institutions. This, in turn, can lead to an overall enhancement in academic outcomes.

Furthermore, the findings of this study will be instrumental in assisting the Ministry of Education (MoE) in shaping educational policies. Identifying potential problems with curriculum implementation and assessment is crucial for refining the education system. By aligning policies with the specific challenges faced by students in chemistry, the MoE can work towards creating a more effective and equitable education system.

In addition to policy development, education funding allocation is another area that will benefit from the study's results. The data can guide authorities in directing resources to the pertinent areas that require additional support. By investing strategically, the education sector can optimize its resources and work towards improving chemistry performance among students.

Efficiency in education is another key concern, and the study's findings can contribute to this aspect as well. By addressing the identified issues, the education system can prevent or minimize resource waste. This means that resources can be allocated more efficiently, ultimately benefiting both students and educators.

The study's original conclusions also have the potential to enhance internal effectiveness in schooling. Educators can use these findings to adapt their teaching methods, curriculum, and support systems to better meet the needs of students in Athi River Sub County. This adaptability can lead to improved outcomes and a more responsive education system.
Finally, the results of this study will add to the existing body of literature on how scientific students perform. This collective knowledge can inform future research, guide educational reforms, and serve as a valuable resource for anyone interested in understanding and improving the educational outcomes of students in chemistry.

1.8 Assumptions of the Study

The reliability and accuracy of the data gathered for this research study are of paramount importance. Several factors contribute to the confidence in the data's accuracy: Firstly, the data provided by the students can be considered accurate and truthful. It is expected that students would provide honest responses, as they are the primary beneficiaries of the educational system being studied.

Secondly, the inclusion of Form 4 learners from various schools ensures that the data collected represents a diverse range of learning experiences. This diversity enhances the likelihood of obtaining reasonably accurate responses that reflect the broader student population's perspectives. Similarly, the data provided by teachers can be relied upon for accuracy and truthfulness. Teachers possess the necessary knowledge and experience to provide meaningful insights into the factors influencing student performance, making their input invaluable to the research findings.

The accuracy of data related to resource access is also ensured, as participants are well-versed in the educational context and have firsthand experience with resource availability and constraints. Additionally, the data regarding teaching methods supplied by teachers can be trusted. Teachers are equipped to reflect on and articulate the methods they employ in their teaching practices, offering valuable insights into instructional strategies.

1.9 Limitation of the Study

The limitations of this study were:

Due to time and financial constraints, only the replies of the sampled students, teachers of chemistry, and institution leaders were used to generalize the study's conclusions.

This research was limited to the chosen participants. All chemistry students, teachers, institution leaders, parents, and other education stakeholders should have been examined for more definitive results. Due to budgetary and other practical limitations, such as scarcity and absence of access, this was not achievable, though.

1.10 Scope and Limitation of the study

In this study, certain limitations were imposed on the methods of data collection and the areas of methodology. Specifically, the study focused exclusively on three key groups within the educational context: form 4 students, teachers of chemistry, and heads of institutions in public secondary schools within the Athi River Sub County. These groups were chosen because they play a direct and pivotal role in matters related to chemistry achievement.

The sampling strategy employed in this study was quite narrow in scope. It exclusively included form 4 students who were actively enrolled in the educational institutions, form 4 teachers of chemistry, and the respective principals of the selected schools within Machakos County's Athi River Sub County. Notably, this meant that other important stakeholders, such as parents, political leaders, and the school sponsors, were intentionally excluded from participating in the study.

While this selective approach allowed for a focused investigation into the perspectives and experiences of those directly involved in the chemistry education process, it's important to acknowledge that the study's findings may not encompass the broader perspectives and influences of the omitted stakeholders. As such, the study's outcomes should be interpreted within the context of these limitations and the specific groups under examination.

CHAPTER TWO
LITERATURE REVIEW

2.1. Introduction

The study of earlier studies that were conducted in a related area addressing how scientific challenges handled will be covered in this chapter. There has been a lot of study on failure, both in and outside of Kenya. While some studies focus on chemistry expertise, others examine methods used in other fields. The chapter will look at related academic material under its subsequent sub-headings: Learners' and Teachers' Techniques for Improving Chemistry Achievement, Teachers' Factors and How They Affect Chemistry Performance, Students' Factors, the Availability of Educational and Instructional Resources, and Faculty Conditions and how they affect Chemistry Performance. The theory that guided the study is the production function theory. The theory seeks to compare inputs and outputs. Inputs and outputs must balance in order for a teacher to acquire job satisfaction, otherwise this would result into high turnover. Lack of support due to huge workload, increasing administrative task burden rather than engaging teachers in academic assignments decreases their job satisfaction

2.2 Empirical literature review

2.2.1 Students' Factors and Performance in Chemistry in Public Secondary Schools

There has been extensive global study on the factors influencing students' performance in chemistry. Some explanations for why children battle in the classroom had been found by the study. According to study by Belinda, government secondary schools in Goma, the Democratic Republic of the Congo, had low educational attainment rates. (2019). The article's objectives included finding problems encountered by students in public schools, analyzing teachers' views on instruction there, and figuring out how social, political, and financial variables affect success in public secondary schools. Balinda, (2019), studies found that a shortage of adequate facilities for learning, culturally, philosophical, and monetary catastrophes, poor management of school funds, a lack of motivation on the part of both students and teachers, and poor educational outcomes on public high school examinations were all factors. According to the research, collaboration between the government, BOM, families, and caregivers is necessary to improve academic performance. This study seeks to ascertain whether some of the topics

addressed in Goma Public Secondary Schools in 2019 have recently had a similar effect in Machakos County, Kenya's Athi River Sub County.

Wabuke (2019) conducted experiments on high schools in the Eldoret municipality for her work, the effect of high school senior factors in the performance of Biology course in secondary schools in Eldoret municipalities. The form 3 students and biological teachers (those instructing form three) were the primary audience in her survey of ten high schools. This same study observed that the following student factors determine biology achievement in the municipal government: upper primary science, which offers the regard to the factors for biology at the level of high school, involvement in biology (theory and practical), their capacity to carry out the practical effectively, students' aspirations and mindset toward human physiology, and available gradually increasing, making use of schoolwork by students to plan their homework, research group meetings, scientific conferences, excursions, and expositions. Contrarily, the research discovered that student disobedience, insubordination, and absence are associated with mediocre performance.

Previous research conducted by Akram and Ikram (2017) shed light on the factors influencing students' performance in chemistry. Their study emphasized the substantial impact of students' interest and motivation on their academic achievements. It was observed that students who exhibited a genuine interest in chemistry and were motivated to learn the subject tended to perform significantly better. In this study, a sample of 100 participants was carefully selected using a stratified random sampling approach. This method was adopted to ensure that the sample represented various strata or groups within the population, thus enhancing the study's validity and reliability. The research focuses on the factors responsible for the declining interest of students in chemistry, a subject of fundamental importance in secondary schools. Chemistry plays a crucial role in preparing students who aspire to pursue careers in science, engineering, and medicine. Despite its significance, there has been a persistent issue of poor performance among students in chemistry, particularly in public secondary schools.

Interest and motivation, as highlighted by Akram and Ikram (2017), can be influenced by various factors. These include personal interests, family background, and the influence of teachers. For instance, students coming from families with a strong scientific background may naturally exhibit a greater interest in chemistry due to exposure and encouragement from their family environment. Additionally, teachers who are enthusiastic and well-versed in the subject

matter can play a pivotal role in nurturing students' interest and motivation, thereby contributing to improved academic performance.

Kampire, and Ntawiha, (2021), researched on student factors affecting their performance in chemistry in public secondary schools, with a focus on the importance of students' attitudes towards the subject. The research design used in this study was a mixed-method approach, combining both quantitative and qualitative data to gain comprehensive insights. The sample included students from various public secondary schools in the chosen location, which was not explicitly mentioned in the available information. The data analysis method involved conducting surveys and interviews to assess students' attitudes towards chemistry. Quantitative data were analyzed using statistical tools to measure the correlation between attitude scores and academic performance, while qualitative data were thematically analyzed to understand the reasons behind positive or negative attitudes. The study found that students' attitudes towards chemistry played a significant role in influencing their performance in the subject. Those with a positive attitude, who perceived chemistry as interesting and relevant, tended to perform better academically. The other hand, students with a negative attitude, viewing chemistry as difficult or irrelevant, showed poorer performance.

In their study, Okoronka (2020) investigated the factors that influence students' performance in chemistry in public secondary schools. They employed a comprehensive data analysis approach to examine various variables that may have an impact on students' academic achievements in the subject. The sampling method used by Okoronka in their study may not be explicitly mentioned here, but in research like this, a common approach is to use random sampling or stratified sampling to ensure representation of different demographics and school types. This ensures that the findings can be generalized to a broader population of public secondary school students studying chemistry. Okoronka's research findings supported the idea that several factors play a significant role in determining students' performance in chemistry. Students who exhibit genuine interest and motivation in chemistry tend to perform better. When students are enthusiastic about the subject, they are more likely to engage actively in their studies, leading to improved academic outcomes. A solid foundation in science and prerequisite knowledge can positively influence a student's performance in chemistry. Students with a good understanding of scientific concepts from earlier grades may find it easier to grasp and apply chemistry concepts. Different students have different learning preferences and

styles. Tailoring teaching methods and resources to match these individual learning styles can enhance comprehension and retention of chemistry concepts. Students' attitudes and perceptions towards chemistry can significantly impact their performance. Positive attitudes foster a more favorable learning experience, while negative attitudes can hinder progress.

Kampire, & Ntawiha, (2021), added that students' attitudes towards chemistry can also affect their performance in the subject. A negative attitude towards the subject, such as perceiving it as difficult or irrelevant, can lead to poor performance. In contrast, a positive attitude can improve students' performance in chemistry. Teachers can help improve students' attitudes by making the subject more interesting and relevant to their daily lives. Okoronka, (2020), found that student factors have significant effects on their performance in chemistry in public secondary schools. Interest and motivation, prior knowledge and skills in science, learning styles, and attitudes towards chemistry are all essential considerations in improving student performance. Teachers, parents, and policymakers should work together to address these factors and provide an enabling environment for students to excel in chemistry. By doing students are required to be equipped with the necessary skills and knowledge to pursue careers in science, engineering, and medicine.

2.2.2 Teachers' Factors and Performance in Chemistry in Public Secondary Schools

In every topic, teachers have a significant influence. Teachers are facilitators who should help students internalize ideas and principles. The primary workforce responsible for having an impact on basic concepts is the teacher. A research on the "causes of poor performance in day scholars in KCSE in Kiambaa division of Kiambu district, Kenya" was undertaken by Wainaina (2015). The study's goals were to determine whether inadequate funding for education, a lack of teacher and student motivation, and less time spent on academic activities led to horrible performance. The study's conclusions showed that day students engaged in very few academically related activities due to a variety of factors, including household responsibilities, a lack of funding for tuition, and a lack of enthusiasm. Wainaina in (2015), study suggested that day schools design their timetables to make the most of their instructional time. To enhance teaching and learning, the Ministry of Education should make more investments in supplies and machinery. In order to express care for the welfare of the students at school and generally establish discipline in the children at home, it is necessary for many

stakeholders to engage in school activities in a broad sense. This will also ensure that everyone recognizes the importance of education. The current study will examine the factors impacting poor performance specifically in chemistry at Athi River Sub County, Machakos County, while the previous study focused on causes of low performance in day scholars and in Kiambaa division, Kenya, which is less densely populated compared with Kiambaa in Kiambu County, Kenya.

Studies by Nyamubi, (2017), on determinants of secondary school teachers' job satisfaction in Tanzania, found that educators be provided more publicity during in initiatives, that classrooms be provided physical infrastructure to encourage learners and thus enhance student achievement, and that head teachers make sure that their institutions have the necessary tools and resources for teaching as well as that the educators adequately cover the curriculum. The new study, which will concentrate on the Chemistry topic rather than the complete KCSE examination, will be carried out in the Athi River Sub County, which has a distinct environment than Makadara. "Education factors impacting students' achievement in KCSE in Homa Bay Sub County Kenya" was a study undertaken by Users in 2020. The report's goals were ever to ascertain the impact of teachers' characteristics, such as their professional backgrounds, and the impact of the availability of teaching and learning resources on students' KCSE performance in public secondary schools in Homa Bay Sub County. According to the study's findings, students performed better in schools with teachers who had more years of experience teaching and professional credentials, and those schools also had access to educational assets like text books, instrumentations, and chemical products, which helped with KCSE achievement.

The school administrators were advised to take their supervisory responsibilities seriously by monitoring teachers in the classroom, reviewing lesson plans, and ensuring that the right students are receiving the proper personnel management services to assist in their academic work. The BOM and PAs of public secondary schools should also make sure that there are enough physical resources available, giving those essential to academic work like labs and libraries priority. Whereas this study focused on performance in general and in the Homa Bay Sub County, this study will examine chemical performance in the semi-arid Athi River Sub County (Jonyo, 2019).

In Nzaui Sub County, Makueni County, Kenya, Kimayu (2020) did a study on the variables affecting Geography performance in the KCSE. He looked into what factors affected how well teachers taught geography and what resources were available in the Nzaui District for doing so. According to the study's findings, 80% of teachers believed they were well qualified, and 76% said that teachers' qualifications have a major influence on student achievement and the resources available for teaching. According to 80% of respondents, Nzaui Sub County kids' achievement in geographical is significantly impacted by a lack of resources.

A research on "administrative factors that influence performance in the KCSE in public day schools in Mwala Sub-County, Kenya" was undertaken by Mutua (2010). The goals were to determine how learning and teaching resources affected KCSE achievement as well as how new curriculum oversight affected KCSE achievement in day secondary schools throughout Mwala Sub County. According to the study's findings, the majority of respondents (79.5%) thought that while there were enough classrooms and furnishings, there weren't enough text books, labs, or library. Also, head teachers' morale was low when it came to overseeing the curriculum's execution, this resulted in subpar performance in the KCSE tests. The research recommends that school principals galvanize assets from multiple interested parties, including the Ministry of Education, guardians, and CDF, and provide sufficient educational manpower. It also advised them to step up their supervising responsibilities to ensure that teachers carry out their duties successfully, as proper curriculum implementation will in turn improve KCSE achievement.

Use of scientific terminology in teaching and achievement in science: A study of selected high schools in Kabarnet division, Baringo Sub County, Kenya, was the subject of a 2018 study by Chesang Chepyegon. The study's major aims were to ascertain regardless of whether teachers of chemistry define and clarify the significance of technical terms unique to chemistry that they come across during instruction, ascertain whether teachers' professional training and experience have any relationship to their ability to define and clarify the significance of scientific jargon unique to chemistry, and ascertain whether the explanations and definitions of technical terms in science school books were adequate.

According to the report's results, chemistry publications in use for training adequately define and explain the meaning of scientific terminology labeling concepts, therefore they are not to

blame for students' subpar performance in the subject. Participants in the study who taught chemistry were unable to emphasize and clearly explain academic vocabularies that designate concepts. This indicates that they're not interested in explaining science information and ideas in plain, understandable language for learners. Eventually, the analysis revealed that while the educators who took part in it were professional manner licensed and competent to teach composition, they were unable to highlight and effectively explain scientific concepts. This resulted in low performance from students and the need to arrange for in-service courses. study by (Chesang Chepyegon, 2018), their study suggested that teachers of chemistry receive in-service training on the importance that scientific terminology play, that they incorporate specialized words in current teaching materials, and that languages teachers usually consult teachers and pass while managing special terminology. The Chesang Chepyegon (2018), study focused on the use of scientific language in instruction and chemistry ability, whereas this study will examine the way that certain chosen variables ultimately affect chemistry achievement. The two studies were conducted in distinct places.

In South Africa, where training and education under apartheid were defined by the underdevelopment of human potential and that of Blacks, a study on characteristics related with high school learners' low performance (Andile & Moses, 2017) was conducted. The hardest damaged areas were math, science, and technology education and learning (Department of Education, DOE, 2001). The elements that contributed to poor performance were divided into two categories by the researchers: direct influences, which include: teaching tactics, topic knowledge and understanding, motivation and interest, laboratory usage, and syllabus non-compliance. Roles and language of the parents are some of the indirect influences. According to Thomas & Pedersen (2018), one of the tenets of the educational profession is to teach as one has been taught. This implies that, for instance, a teacher who received their education in and, these factors relate to this studysince the factors are similar despite the environment. Students’ and teachers’ perception on the causes of poor academic performance in Ogun state secondary schools in Nigeria Asikhia (2019). This study examined the perception of students and teachers on the causes of poorperformance among secondary school students in Ogun state, Nigeria.

Do prior education level, age group, and course load matter? Is a study from Wawason Open University.; both Teoh and Liew. The report's objective was to figure out whether the students' prior formal schooling or age, when combined with the semester class schedule, could have an impact on how well they performed. Each student's grade point average (GPA) for each trimester was utilized to evaluate their progress. Grade point average (GPA) is derived by dividing the total grade points by the number credit hours tried. According to the report's results, a patient's Cumulative Gpa Estimate was strongly affected by one‘s education experience rather than by the number of courses they enrolled for. Students from different age groups and students will be selected also showed little correlation between their course registration and GPA.

Sutton (2018) made the suggestion that raising teacher quality would have a significant impact on the performance of the nation's schools, raising student accomplishment across the board, in his study examining the effect of teachers on student achievement in the UK. In schools, teachers are by far the most valuable resource. Teachers are the most significant element in schools that legislators can directly influence to raise student achievement, according to research. The achievement of students is improved when they have a very successful instructor as opposed to an ordinary one.

2.2.3 Resource Access and Performance in Chemistry in Public Secondary Schools

In the community college of Butaganzwa commune in the Kayanza area of Burundi, there are a number of variables that influence students' academic achievement, according to Caleb's (2018) research. In order to determine the relationship between educational attainment in the communal college of Butaganzwa commune in Kayanza province, Burundi, and the availability of learning resources like archives, studies, and educational tools and equipment, as well as classroom conditions like student-to-teacher ratios and teacher caseloads, the report looked at both of these factors.

The report's findings indicate that an assortment of factors contributed to the low academic achievement in Butaganzwa commune in Kayanza province, Burundi, including a lack of instructional resources and a support program (library), laboratory space and scientific equipment and materials, handbooks and furnished teacher educators, a shortage of experienced educators, a poor learning environment, a rising student-to-teacher ratio, and

educators' workload. The researcher suggested employing qualified individuals to improve scholastic achievement in the study area and urged the municipality to solicit funding from neighboring non-profit organizations for the establishment of regional agencies. Caleb conducted his studies for college students using a unique Burundian school system, whereas the current study will focus on secondary students in Kenya using the 8-4-4 educational system.

Similar research on the causes of subpar academic achievement in primary school pre requisites in Mromero District, Morogoro Region, was done in Tanzania by Kubahari (2018). The survey's goals was ever to determine whether there was a connection seen between quality of an academy's amenities and students' achievement on national examinations, between the number of teachers and students' achievement on public examinations, as well as the happiness of educators and students' achievement on national examinations. According to the data analysis outcomes, there was a substantial association between student achievement and the state of the college's amenities, as well as a similar link between student success on national tests and the quantity of teachers.

The researcher proposed that the Department of Education should give the institution with suitable physical infrastructure, and that the state should provide the Ministry of Education and Culture with more than enough funding to cover the costs of the infrastructure facilities the schools require. Also, the state needs to hire enough teachers in the classrooms to ensure efficient learning and instruction. Kubahari conducted research on the primary school performance-related elements and the Tanzanian educational system, but the current study will employ secondary school students and the Kenyan school organization, which itself is distinct from Tanzania's. Teachers' answers revealed that poor academic achievement is more influenced by teaching methods than by teacher qualifications or the surroundings of the students. On the other side, the patient's reaction indicated that subpar achievement is a result of the school's instructional techniques and learning resources. The factors that were defined in the investigation for study objectives and instruments for gathering data were student's poor or scholarly achievement and teachers' credentials, educators' poor academic performance as well as educators' technique of instructional and educators' surroundings and poor academic performance. These elements provide a baseline for comparison with the elements contributing to low achievement for students in secondary schools in Tanzania.

Adesoji (2018) conducted research on learners, instructor and educational situational variables as predictors of performance in senior secondary school chemistry in Oyo estate, Nigeria. The report's goals was ever to determine as to if factors relating to students, such as mindset and basic knowledge in incorporated scientific research, educators, such as science teachers' attitudes and training participation, and education factors, such as classroom management, research lab capacity, and parental education, focus on providing inferences for high school students' accomplishment in chemistry. According to the report's conclusions, just four components location, laboratories quality, teachers' science instructional attitudes, and educators' participation at trainings a clear significant bearing on students' performance in chemistry. These four dimensions were classroom geography, instructor chemistry teaching philosophy, instructor conference participation, equipment competence, and lastly instructor commitment toward teaching chemistry. Hence, it is believed that children who attend the school in an urban area, have access to a well-equipped lab, and have an interest in attending workshops will perform very well in chemistry. The study suggested that elected officials and those involved in the education industry should improve the learning experience for students. They ought to inspire teachers who carry out coursework.

In accordance with a study by Kabala (2020) on school-based factors influencing educators' school achievement at the KCSE aptitude test with in Makadara District of Kenya, the original study goals included assessing the consequences of instructional and educational materials on educators' achievement at the KCSE, to assess the influence of facilities provided on educators' achievement at the KSCE, and to determine whether accessibility of educators has an influence on student's achievement. The report's main conclusions were that inadequate physical infrastructures and students' inability to finish coursework had an adverse effect on achievement in colleges, and that the face professor's inability to regularly check educators' required reports, such as schemes of work, documentation of work, and students' advancement registers, was a factor in poor achievement. "Effect of resources utilization on the achievement of Physics in KCSE in public secondary schools in Ugunja/Ugenya Sub County, Siaya County Kenya," according to Okoth's (2018) report The report's goals included determining the accessibility and/or level of use of the resources for boosting performance in KCSE physics and identifying tactics for doing so.

Ambogo,(2010) in his research, he looked at how well students performed on the scientific subjects on the Kenya Certificate of Secondary Education (KCSE) exam in connection to the availability of both human and non-human resources for teaching and learning. According to his research, best ranked institutions had more access to texts, laboratories reagents, and apparatus than poor performing schools did. The results demonstrate that only one of the five poor performing schools with a scientific lab was completely equipped, and only two of the seven low performing schools with a biology lab had a laboratories specialist. There have been variations in the available resources for instructional purposes. The authors suggest that the ministry of education start more trainings in material supply, adaptation, and use as well as support the improvement of science courses like SMASSE.

Under achievement in high schools was the subject of research done in the USA by Belinda (2010). Her study investigates if the interaction between health issues and the learning environment affects academic performance. The research looks into the relationship between adolescent health and education. The researcher set out to identify students' preferences for science subjects, establish a link between those desires and scientific knowledge achievement, pinpoint the impact of those choices on achievement, and then recommend methods for bolstering that link in hopes of enhancing academic performance and pique participants' interests in their preferred science courses. The study suggests that participants should receive assistance and counselling, especially about future-related issues. To prevent the risk of losing some young scientists who might have dropped optional science classes, the government should make science courses required, and school systems should indeed be ensured to have an adequate supply of teaching and learning materials, such as school books, laboratory work, as well as other facilities, to facilitate the learning process. Belinda (2010).

Jerry (2019) carried out an investigation akin to this in Nigeria, where high school students' achievement in scientific classes was extremely subpar. The insufficient relevant studies in high schools, which also include research labs and tools, the absence of competent and dedicated educators, the inability of the students to accomplish well in practical, and the instructional methods used by teachers like Akinola, were some of the variables that led to this poor performance (2016). The majority of high school curricula are written by foreign authors that employ complicated language that is challenging for students to comprehend. Lack of

scientific supplies, a shortage of adequate and high-quality publications, the idea that science is difficult, students' lethargy, and just a lack of time to set out for practical teaching are all contributing factors to the drop in bad science achievement in Malawi (Dzana, 2018).

Does a student's preference for science subjects effect how well they undertake? A case of Udzungwa secondary school in Kilolo, Iringa, Tanzania, according to Siwel and Kizito (2018). The research looked into the variables that can affect students' choices for scientific courses. In hopes of enhancing scholarly achievement and encourage educators' aspirations or priorities in science courses, the study set out to identify educators' desires for science courses, build a connection among these choices and achievement in science courses, and then identify the effect of choice on achievement.

Factors affecting students' school achievement in high schools built by the government and the community (Mlozi and Nyamba, 2018), with a focus on the Tanzanian municipality of Mbeya. The study evaluated the quality of educational inputs, looked at classroom instruction, compared students' academic achievement between forms 2 and form 4 national examination results from 2016 to 2018, and investigated public opinion of neighborhood secondary schools. According to their results, there were insufficient teaching and learning resources and subpar teaching and learning processes, particularly in secondary schools sponsored by the local community. The number of students and the facilities available in the schools were not equal.

In a case of selected schools in Moshi district, Tanzania (Cyril & Lucas, 2017), in their research: Factors influencing academic performance in ward secondary schools. The focus of their study was the link between education providers, facilitators and learning environment, which included all facilities and infrastructure, availability of materials and performance of ward secondary schools at the district level. While the examination was written in English, the majority of the instruction was done in a combination of English and Kiswahili. According to their results, society high schools performed academically worse than state high schools between 2016 and 2018 in form 2 and form 4 national examinations. The researchers proposed that the government hire more teachers and offer classrooms, labs, and other teaching and learning resources like textbooks.

According to the research, the town's ward high schools can't handle very well. Academic success is hindered by a variety of problems, including: a shortage of educational settings that are favorable to studying, a lack of teaching and learning resources, and a dearth of teachers compared to the amount of students for each topic. Lack of well-stocked libraries and laboratory, poor communication among teachers, families, and children, and poor classroom attendance by both teachers and students were other factors linked to this performance. They came to the conclusion that additional data needed to be gathered in order to make a good generalization and have a better grasp of the elements influencing academic achievement in Tanzania's ward high schools.

The relationship between examination practice and curricular objectives in Tanzania was examined by researchers from the Department of Education Psychology and Curriculum Studies at UDSM (Mkumbo, 2019) and Haki Elimu Tanzania. Tanzania has a competency-based curriculum, although the usage of textual materials (poor or low quality) makes it difficult to put this form of curriculum into practice. The researchers employed content analysis of curriculum materials and exam papers to determine the relationship and synergies between the two parts of Tanzanian educational systems. Focus groups were conducted with subject matter experts as well as teachers who have experience setting, supervising, and marking exams.

The deliberations in the participant observation looked at how these sources view Tanzania's ultimately serve and how they relate to the implementation of the curriculum. To get teachers' perspectives and ideas on the relationship between curricular preparation and assessment success, a questionnaire was used. A top NECTA official was the subject of one interview. The study suggests that courses, packages, and instructions as well as reference materials, graphs, charts, periodicals, and periodicals be used to develop competency-based curricula.

ICT resources, as well as scientific and artistic teaching tools like samples, real resources, models, and lab equipment, must be made available to teachers in schools. These findings are pertinent to the study because they are consistent with characteristics being looked into that are thought to contribute to students' poor output in science-related secondary education courses. Does a student's preference for science subjects effect how well they perform? An

example is the Udzungwa Secondary School case, Siwel & Kizito, Kilolo, Iringa, Tanzania (2020).

Their research was prompted by the reality that students' enthusiasm in studying science has changed significantly over time. They particularly looked for students' preferences for science subjects, examine teachers' and students' perceptions of those choices, establish an association between those preferences and students' performance in those subjects, pinpoint the impact of those choices on effectiveness, and afterwards recommend ways to strengthen that link in hopes of enhancing school achievement and to further students' involvement or desires in scientific knowledge.

Researchers have found that time of life of students, physical intimacy, misunderstanding, dearth of educational experiences, institutional sexism by subject teachers, and inadequate advice to classmates on the prospective significance of scientific knowledge were among the likely reasons of student preference and poor performance on science subjects at ordinary level in secondary schools. The studies suggest that secondary schools be provided access to sufficient educational resources, including books, lab equipment, as well as other facilities to facilitate the learning process. The current trend in science topics in Kenyan secondary schools is influenced by similar reasons.

2.2.4 Methods Used to Improve Performance in Chemistry in Public Secondary Schools

Whenever applied appropriately by educators, successful chemistry instruction that includes student participation boosts educational success in scientific courses at the secondary and postsecondary levels (Mahdi, 2018). Ajayi (2017) asserts that a chemistry teacher should strive to switch from lecturing to creative developing skills like cooperative learning and concept mapping by using improvised materials where there is no science equipment. Flexible teachers must employ cutting-edge teaching techniques that adapt the content to students with a variety of skills and talents (Sibomana et al. 2021).

Educational attainment is independent of teaching and learning. Lecture-style training doesn't really motivate students to learn, and there is no one best teaching approach (Jumay, 2016). Also, it is not advisable to utilize a single teaching technique because students have various learning preferences and pay attention when the teaching tactics stimulate them (Okwuduba,

2018). In order to maximize student achievement, teachers of chemistry should use a variety of strategies, including engaging students in educational activities and teaching concepts in order from simple to complex. This will help students understand abstract or complex concepts; otherwise, they may simply memorize what they are taught without understanding it (Yusuf, 2014). Some educators use time-honored methods of instruction that put the teacher first and see the students as merely passive recipients of information. As a result, the previous knowledge is not properly put into use (Akram et al, 2017).

inadequate instruction Low student achievement in chemistry is the result of various teaching methods, and a World Bank report found that youth in Sub-Saharan Africa who perform poorly on examinations lack the skills and knowledge required to be eligible for employment and STEM-related post-secondary courses that would prepare them for well-paying jobs (World Bank, 2016). Teachers of chemistry should use a variety of teaching techniques to help students understand what they are learning. No approach may be regarded as the best for every educational setting, according to Nkemakolam et al. (2018). Teachers of chemistry should be aware of some broad principles so they may select instructional methodologies, according to Ejidike, Oyelana, and Tenaw (2015). These guidelines take into account the age of the students, their prior knowledge of the subject, and also their aptitude. Effective teaching techniques can increase students' interest in a subject (Tolsdorf et al., 2018); additionally, learning should involve teamwork and communication among students, who are at the heart of the learning process (Aminah& ASL, 2015; Kara, 2018). Research have shown that a variety of cutting-edge teaching techniques, including peer tutoring (Amedin and Gudi, 2017; Gagne's Learning Hierarchy, Yusuf's (2014); Inquiry teaching style, Harcourt(2017); and computer simulations, Nkemakolan et al.), boost students' progress in Chemistry (2018).

2.3 Theoretical Framework

Production Function Theory Served as the study’s guiding Theory. The Theory states that education is a production process that use limited financial, human and physical resources to produce educated individuals (Jagero 2020). This theory served as the guiding framework for the study, offering a structured lens through which to analyze the complex dynamics of the education system. This conceptual framework provides a foundation for understanding how different inputs contribute to the production of educational outcomes, in this case, students'

achievement in chemistry. One fundamental aspect of the theory is the distinction between exogenous and endogenous inputs.

Exogenous inputs are external factors over which schools have no direct control, such as poverty, income levels, political influences, and the broader environmental context. In the context of this investigation, the theory allows researchers to explore how these exogenous inputs impact students' performance in chemistry. For instance, poverty may restrict access to essential study materials, while political instability can disrupt the overall learning environment.

Conversely, endogenous inputs are those elements that schools can directly influence and control. These inputs encompass educators, students, educational resources, and facilities, including information and communication technology (ICT) infrastructure. By applying the Production Function Theory, researchers can delve into how the allocation and utilization of these resources influence students' achievement in chemistry. This might involve evaluating the effectiveness of teachers of chemistry, the availability of instructional materials, and the integration of ICT facilities into the teaching and learning process.

The sample only comprised of form 4 students who are currently enrolled and form 4 teachers who teach in Athi River Sub County, Machakos County. The greatest output that is produced from a specific set of inputs is determined using the factors of production. Applying this research outcome, it can be said that students' school achievement all through examinations is a component of one‘s perceived notion of a given subject, the accessibility, expertise, and expertise of their teachers, the resources available for use in teaching and learning, the availability of ICT facilities and how they are used, as well as various performance-enhancing techniques. This data can be expressed as follows in a production function:

$A = f(S_p, T_{qe}, R_{au}, I_{fu}, S_{if}, \text{----------}\mathcal{E})$

Where A= Achievement of students (examination performance)

f =Function

S_p=Students’ perception towards a subject

T_{qe}=Teacher’s availability, qualification, and experience

R_{au}=Resource availability and their use

I_{fu}=ICT facilities and their use

S_{if}= Strategies used by learners and teachers to improve performance

Ɛ= Error term due to other inputs

The formalized establishment known as the school, where students receive an education and are evaluated through exams, functions as a corporation or enterprise. According to the notion of the production function, the "raw materials," or the students and other participants like teachers, books, lab supplies, and ICT materials, serve as inputs. The procedure to produce particular outputs, like academic performance, is the interaction of students during the teaching and learning process. As a result, the school transforms students from being human raw materials into more useful, valuable individuals who possess the information, attitude, and skills necessary to pursue higher education or become skilled and marketable adults.

In this specific investigation, four key stakeholders were involved: students, teachers of chemistry, and institution heads from public secondary schools in Athi River Sub-County, all of whom have direct involvement with the chemistry subject. By examining the interplay between these stakeholders and the various inputs they contribute, the study can gain insights into how the Production Function Theory manifests in the local educational context and how it may explain the observed low achievement in chemistry.

In essence, Production Function Theory serves as a valuable framework for understanding the multifaceted factors contributing to students' low achievement in chemistry. It provides a structured approach to analyze both external and internal influences on the education production process, offering a path to identify potential areas for improvement and interventions that can enhance students' performance in this critical subject.

2.4 Research Gaps

This research report aims to identify key research gaps in the study titled "An Investigation of Factors Influencing Students' Low Achievement in Chemistry in Public Secondary Schools in Athi River Sub-County, Machakos County, Kenya." The study's objectives include examining students' and teachers' factors affecting chemistry performance and resource access, as well as exploring effective teaching methods. Through a review of existing literature, several research gaps have been identified, which necessitate further investigation and exploration.

Existing literature indicates a significant research gap regarding the lack of focus on specific subgroups of students. This includes subgroups such as gender, socioeconomic background,

and prior academic performance. To gain a comprehensive understanding of the factors influencing students' low achievement in chemistry, future research should examine how these factors affect different groups differently. This would enable tailored interventions for specific student demographics.

The role of non-academic factors, such as motivation, study habits, and extracurricular activities, in influencing students' chemistry performance has been underexplored. It is crucial to understand how these non-academic factors interact with academic performance and what strategies can be implemented to enhance students' engagement and motivation in chemistry.

The literature review highlights a limited investigation into the impact of teachers' teaching methods, experience, and professional development on students' chemistry performance. Future research should delve deeper into how these teacher-related factors influence student outcomes. Moreover, the absence of a detailed analysis of teachers' perceptions, attitudes, and instructional strategies is a notable research gap. Understanding the teacher-student dynamics and their influence on achievement is essential for targeted teacher training and support.

An additional research gap pertains to resource access in public secondary schools. The study objectives indicate the need for a more in-depth examination of the specific resources (e.g., laboratory equipment, textbooks, teaching aids) and how their availability or lack thereof affects chemistry performance. Furthermore, there is a lack of consideration of regional variations in resource access and its impact on student achievement in chemistry. Research should aim to uncover the disparities in resource availability and its implications for educational outcomes.

While the study objectives suggest an examination of the methods used by teachers to enhance chemistry performance, the literature review reveals an absence of a comprehensive exploration of innovative teaching methods, technology integration, or pedagogical approaches. Investigating these innovative approaches, and their effectiveness, is crucial in addressing the evolving educational landscape and providing educators with effective strategies to raise chemistry performance levels.

This research report has identified significant research gaps in the study focusing on factors influencing students' low achievement in chemistry in public secondary schools in Athi River

Sub-County, Machakos County, Kenya. Addressing these gaps through further research and exploration will contribute to a more comprehensive understanding of the issue and enable the development of targeted interventions to improve students' chemistry performance.

2.4 Conceptual framework

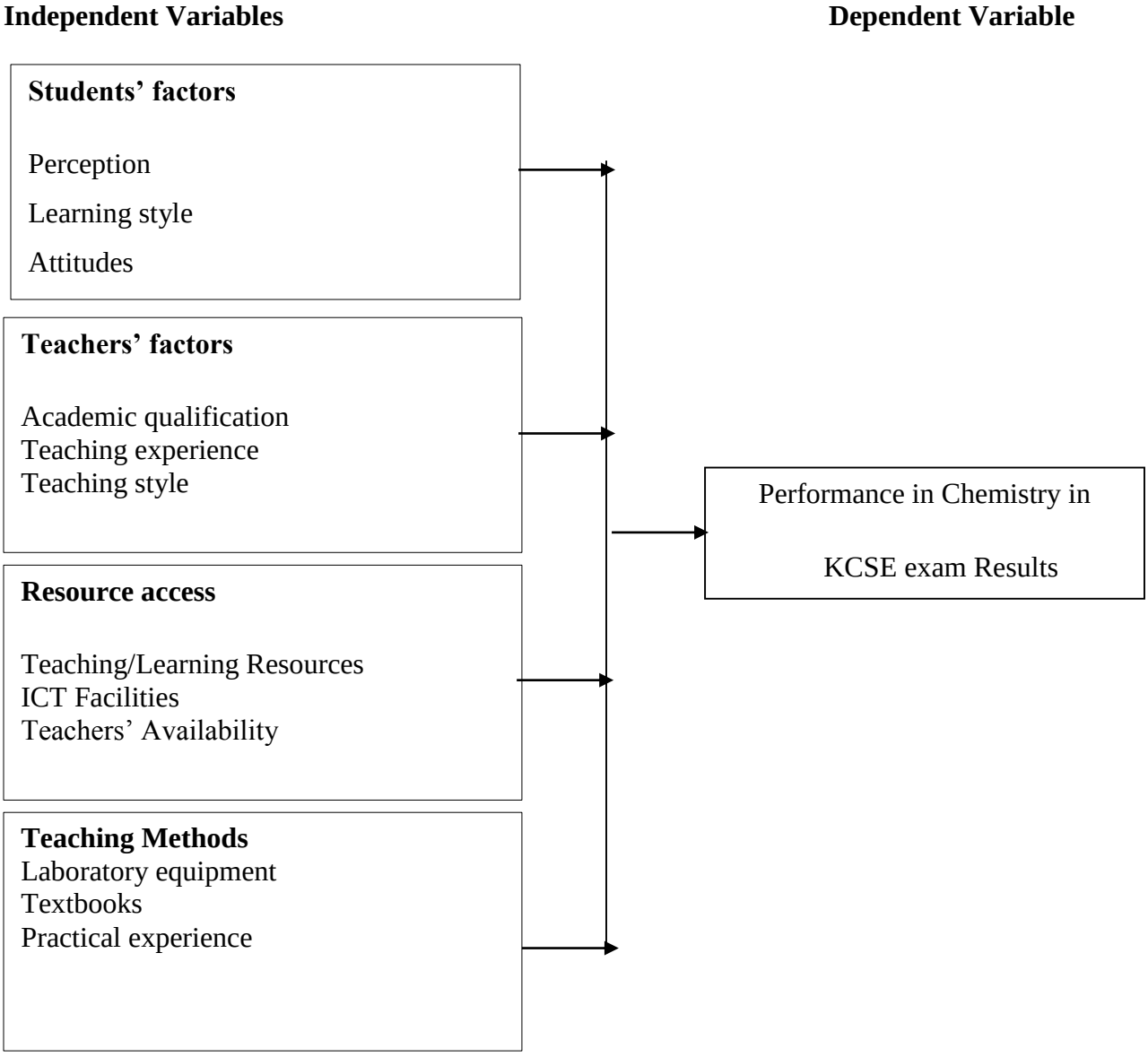


Fig 1.1 Conceptual Framework for the Study

Source: Author (2023)

Pedagogical strategies, teaching and learning technologies, and views of learning are only a few of the variables that Weinberg (2019) claims have an impact on an educational system.

Only issues pertaining to students' teachers, and schools will be the subject of this research. This is because they are the root causes of the learning environment and, consequently, the growth of knowledge and abilities required for success in chemistry. The independent variables are made up of factors related to students, teachers, and the school. These make up the main factors in the educational environment that affect test results. Student-related features include students' impressions of a certain subject or item, learner identity, and even the study methods they use. Training, experience, instructional strategies, ICT resource utilization, and teaching materials all contribute to a teacher's abilities to influence student accomplishment. The teachers' accessibility, ICT resources like laptops and the internet, and instructional resources like textbooks, labs, and classes are all examples of school components. The school, the teachers, and the students are the independent variables that interact with one another during the teaching and learning process. The teaching and learning environment is the approach that eventually influences educational outcomes (which are dependent variables) under the pretext of chemistry performance on the KCSE test.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

Research Design, Study Location, Study Population, Sample Size and Sampling Methods, Research Instrument, Pilot Study, Data Collecting Techniques, Data Analysis, and lastly Logical and Ethical Study Considerations are covered in this chapter.

3.2 Research Design

This study was descriptive in nature. Orodho (2019) claims that descriptive survey research aims to gather information by interviewing or distributing a questionnaire to a sample of people in order to provide statistical data on education that is of relevance to policy makers and educators. The KCSE chemistry performance under study has already taken place. The researcher also used Ex-post facto research due to the fact that independent variables cannot be directly controlled because they already exist.

3.3 Study Location

The research was carried out within the precise geographic coordinates of Machakos County in Kenya, specifically targeting the administrative region known as Athi River Sub County. This selection was made based on a well-founded rationale. The area of interest was chosen due to the persistent underperformance of students in chemistry, a fact substantiated by the documented results of the KCSE exams, as displayed in Table 1.1. The decision to focus on Athi River Sub County was not arbitrary; rather, it was a deliberate choice driven by the pressing need to address the educational challenges faced by pupils in this specific region. Given the extensive scope of Athi River Sub County, coupled with the constraints of limited time and resources allocated for the research, the study opted to concentrate its efforts on a representative sample of secondary schools within the boundaries of Athi River Sub County. This approach allowed for a more manageable and in-depth examination of the issues affecting chemistry education in the area, while still providing valuable insights into the broader educational landscape of the region.

3.4 Study Population

There are now 16 public secondary schools in Athi River Sub County, Machakos County, that offer the KCSE test (See appendix IV). For the fourth-form exams, chemistry is offered in every school. In the Sub County, there are 16 public secondary schools, 12 mixed-day schools,

1 boy's school, and 1 girl's school. The principals, teachers of chemistry, and form 4 students pursuing chemistry were targeted due to time and financial restrictions.

3.5 Sampling Procedure

3.5.1 Sample Size

Sampling is the process of choosing a predetermined number of individuals to represent a specific community. Any conclusions drawn from the sample should hold for the entire population (Orodho 2018). The researcher chose 14 public secondary schools, representing 87.5% sample of the population. Each principal from the selected schools automatically became a respondent. One chemistry teacher from each of the chosen schools made up the sample size of teachers of chemistry, and a total of 140 students from the sampled schools were used. So, 140 Form 4 students, 14 Teachers of chemistry, and 14 Principals made up the study's total of 168 respondents (Athi River Sub County, 2022).

3.5.2 Sampling Techniques

To choose the public schools that made up the sample for this study, stratified sampling was used. Principals were sampled in this study because they play a crucial role in shaping the overall policies and practices within a school. They are often responsible for decision-making, resource allocation, curriculum development, and staff management. As a result, studying their perspectives and experiences provide valuable insights into the functioning and effectiveness of the school in terms of chemistry performance. The public schools' sample sizes was distributed proportionally among each strata. This is as a result of the target population's diversity. In this study, there were three stratum that include various school kinds, including mixed-day secondary schools, boys' secondary school and girls' secondary school. Each stratum's required number of schools was proportionally chosen (Table 3.1).Every chosen school's principal automatically participated in the study. 10 students from the sampled schools was randomly chosen, and 1 Teachers of chemistry from each of the selected schools participated in the study. According to Teachers Service Commission's (TSC) data in the sub county, there are 35 Teachers of chemistry. The researcher used stratified random sampling to select one Chemistry teacher from each of the selected schools. This was due to the fact that there are schools with more than one Chemistry teacher. There are 1,267 form 4 Chemistry students in the public secondary schools in Athi River Sub County, Machakos County.

Gay (2003) posits that when the target population is small, the sample selected should be at least 20% of the population. The researcher selected a proportion of 40% of form 4 Chemistry students in each of the selected schools. For the mixed schools, the researcher had a proportion of 20% for each of the gender. Mugenda&Mugenda (1999), descriptive research requires at least 10% of the accessible population. In the selection of form four chemistry students to fill the instruments, simple random selection was used.

Table 3.1: Number of school types in secondary schools in Athi River Sub County

School type	Number of schools	Sample	Proportion selected. (%)	Principals	Teachers of chemistry	Students
Boys	1	1	40	1	1	10
Girls	1	1	40	1	1	10
Mixed day	14	12	40	12	12	120

Source: Author (2023)

3.6 Data collection procedure

This study used questionnaires to gather information from principals, teachers of chemistry and form four students.

3.6.1 Data Collection Techniques

Three questionnaires were created by the researcher. The data generated by this instrument enabled evaluation and analysis of the data. Because any person could read, understand, and complete a questionnaire, it is also thought that questionnaires are perfect for gathering information from principals, teachers, and students. They enable quick information gathering from a huge number of respondents, guarantee anonymity, and also remove interviewer bias (Orodho, 2019).

3.6.2 Data Collections Tools

The three sets of questionnaires used in the study were:

3.6.2.1 Principal's Questionnaires

School principals were contacted to gather information using this form (Appendix 1). This was due to the fact that principals are in charge of the management of teachers in schools, making direct purchases of school supplies including ICT infrastructure and instructional materials, and establishing the overall teaching and learning environment. The questionnaire for the head teacher contained four sections. Information about the past is sought in Section A. The perception of students' chemical achievement was covered in Section B. Part C focused on teachers' qualification and their experience and how it influence students' progress in chemistry. Part D examined tactics used to improve achievement in chemistry as well as the availability of ICT facilities and other teaching and learning tools and how they are used to influence students' chemistry achievement.

3.6.6.2 Teachers of chemistry Questionnaires

The tool (appendix 2) was used to gather data from teachers of chemistry. There were five sections in the questionnaire. Information about general information was gathered in Section A. Information on the perceptions of teachers and students in relation to chemistry achievement is sought in Section B. Part C was examine the training and experience of teachers. The availability of ICT facilities and other teaching and learning resources, such as laboratory technicians, was the main topic of Section D. The tactics employed to affect students' performance on chemistry exams was the main topic of Part E.

3.6.6.3 Chemistry Students Questionnaires

The students in the sampled schools were surveyed using this tool (Appendix 3). There were three sections on the questionnaires. Information about the general population and student perceptions was gathered in Part A. Information about teachers' factors was provided in Section B. Information on the availability of ICT facilities, teaching resources, and their use to influence students' performance on the chemistry examination was sought after in Section C.

3.6.3 Ethical Considerations

The data collection process commenced with the acquisition of the necessary approvals and permits. Following a letter of support from KCA University administrators, the researcher initiated the process by applying for a research permit from the Ministry of Education, specifically for conducting research within the targeted Sub County. Consent from the Sub

County Director of Education's office, located near Athi River, was duly obtained as an essential step in securing the required permissions. Additionally, the researcher pursued a research permit from the National Commission for Science, Technology, and Innovation (NACOSTI), and this application was successfully approved.

In order to establish a foundation of trust and respect with the respondents, paramount steps were taken to ensure their participation was informed and voluntary. The researcher explicitly assured each participant of the utmost confidentiality, emphasizing that the information provided would be exclusively used for the purposes of this research project. This approach not only upheld the ethical standards of research but also instilled confidence in the participants, setting a conducive atmosphere for their involvement.

Moreover, the study meticulously adhered to proper protocols for obtaining informed consent. Consent was sought not only from the Sub County Director of Education's office but also from the relevant school officials at each of the visited schools where data collection took place. These informed consent procedures were rigorously followed, and the participants were provided with clear guarantees of privacy and anonymity throughout the data collection process. This ensured that every participant's rights and interests were respected, and their willingness to contribute to the research was fully acknowledged and respected.

3.7 Validity and Reliability of the Research Instruments

3.7.1 Pilot Study

Orodho (2019) claims that piloting is carried out by putting the Data Collection equipment in front of a small representative sample that is the same as, but not the group that will be surveyed. By altering the components that are discovered to be confusing, vague, unclear, or unimportant, piloting aids the researcher in improving the instruments. To increase the validity and reliability of the study tools, piloting was carried out in public secondary schools in the Nairobi Embakasi South Sub County. Public secondary schools in Nairobi Embakasi South Sub county were randomly chosen for the pilot project, were also included in the overall research.

Questionnaires was distributed to the principals, the teachers of chemistry, and 10 Form 4 students from each of the chosen schools. The questionnaires were then collected. The

responses provided were verified. In order to prepare for actual data collection, questions that are nebulous, confusing, imprecise, or irrelevant was changed or eliminated.

3.7.2 Validity of the Research Instruments

The degree to which the research instrument truly measures what it was designed to assess (Kothari 2019) or the extent to which the outcomes of the data analysis accurately reflect the phenomenon being studied (Mugenda &Mugenda 2003). The judgment of specialists were sought in order to confirm the validity of the instrument to be used in the study. Two supervisors from the school of education, Arts and social sciences who are highly knowledgeable about the area of study were shown and approved the instruments.

3.7.3 Reliability of the Research Instrument

The consistency of a measurement tool across time is what is meant by reliability. Reliability is defined by Orodho (2019) as the extent to which an instrument measures in the same manner each time it is used with the same subjects and under the same circumstances. The test-retest method entails giving the same instrument to the same group of individuals twice in order to evaluate the dependability of the data (Mugenda. 2018). The reliability of the research questionnaire was assessed using Cronbach's Alpha, a widely accepted measure of internal consistency. The calculated Cronbach's Alpha coefficient was found to be 0.975, indicating an exceptionally high level of reliability for the questionnaire. This coefficient suggests that the items within the questionnaire are highly consistent in measuring the intended constructs or variables. This high level of reliability boosts confidence in the questionnaire's ability to accurately capture and measure the constructs of interest, enhancing the overall quality of the research findings.

3.8 Data Analysis Techniques

After all the data was gathered, all instruments were cross-checked to identify any erroneous, incomplete, or inappropriate data. The quality was then be improved by the rectification of any discovered faults and omissions. Data was coded in accordance with the study's goals before being placed into a computer for analysis. Microsoft Excel was used by the researcher to examine the data. Both quantitative and qualitative methods were used in the data analysis process. Descriptive surveys are frequently represented by the use of frequency tables, graphs, pie-chart means, computation of percentages, and accurately tabulating them, according to

Orodho & Kombo (2015). Descriptive statistics, including frequency tables, averages and percentages, charts, and bar graphs, will be used to assess quantitative data.

Qualitative data was evaluated using content analysis. This was based on analyzing the implications and meaning of the information provided by the respondents, as well as comparing the results to information that has been documented about ways to raise students' achievement in chemistry. In accordance with the study's goals, the qualitative data will be presented topically. The fact that the data is grouped into topics based on the opinions, beliefs, and perceptions of the respondents led to the selection of this methodology. When used to analyze oral interviews and questionnaires, which are the main tools in data gathering for the study, this method is rapid and simple.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSIONS

4.1 Introduction

The chapter presents an analysis of the data collected from a sample of 12 schools 12 teachers of chemistry 12 principals and 120 students. Methods that were used during analysis are calculation of percentages and use of representative tables.

4.2 Response Rate

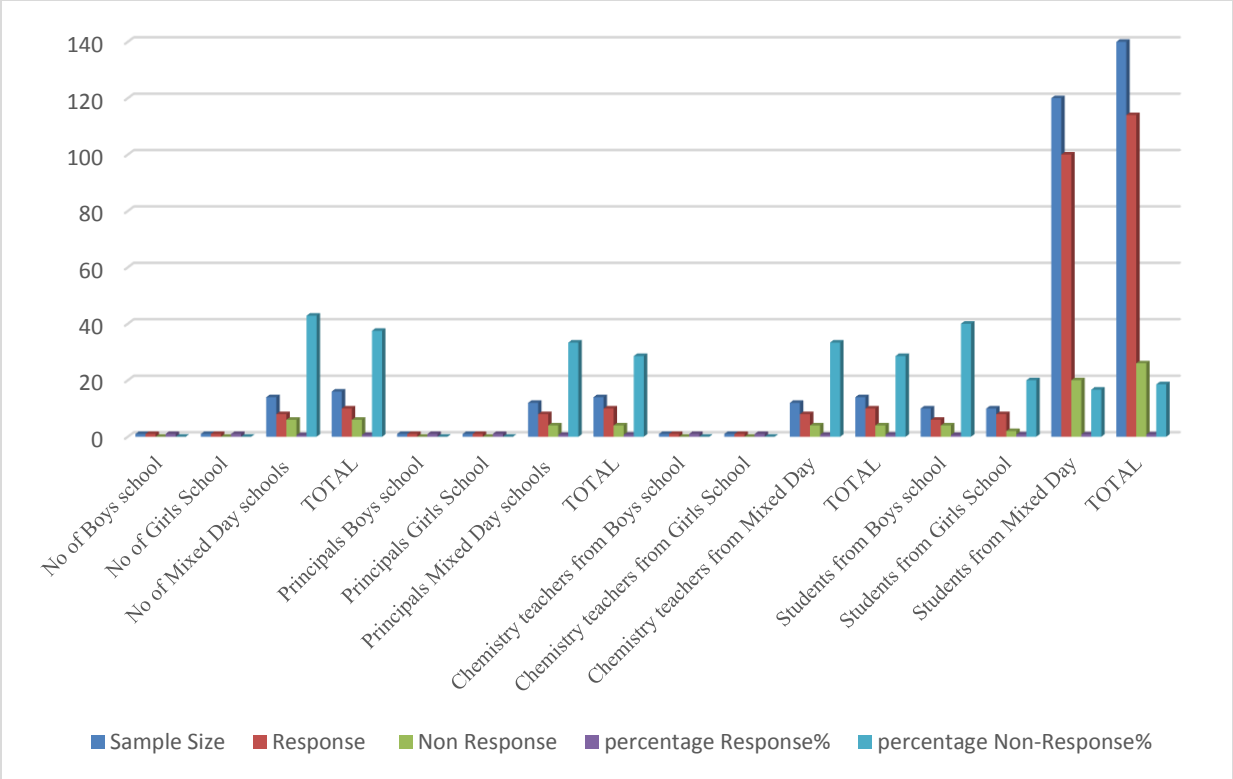
The study sought to establish the response rate based on questionnaires as shown on tables 4.2.

Table 4.2.1 Response Rate

Response Rate	Sample Size	Response	Non Response	percentage Response%	percentage Non-Response%
No of Boys school	1	1	0	100%	0%
No of Girls School	1	1	0	100%	0%
No of Mixed Day schools	14	8	6	57%	43%
TOTAL	**16**	**10**	**6**	**63%**	**38%**
Principals Boys school	1	1	0	100%	0%
Principals Girls School	1	1	0	100%	0%
Principals Mixed Day schools	12	8	4	67%	33%
TOTAL	**14**	**10**	**4**	**71%**	**29%**
Teachers of chemistry from Boys school	1	1	0	100%	0%
Teachers of chemistry from Girls School	1	1	0	100%	0%
Teachers of chemistry from Mixed Day	12	8	4	67%	33%
TOTAL	**14**	**10**	**4**	**71%**	**29%**
Students from Boys school	10	6	4	60%	40%
Students from Girls School	10	8	2	80%	20%
Students from Mixed Day	120	100	20	83%	17%
TOTAL	**140**	**114**	**26**	**81%**	**19%**

Source: Author (2023)

Figure 4.2.1 Response Rate



Source: Author (2023)

Table 4.2.1 presents the response rates obtained from questionnaires distributed to respondents, categorizing the data into response percentages and non-response percentages across different school types and respondent categories. For Boys schools, Girls schools, and Mixed Day schools, the response rates were remarkably high, with 100% response rates in the case of Boys and Girls schools, indicating full participation from these institutions. However, Mixed Day schools exhibited a response rate of 57%, with a corresponding non-response rate of 43%, suggesting a moderate level of engagement within this category. When analyzing the responses from school principals, a similar trend emerges. Principals from Boys and Girls schools exhibited 100% participation, while principals from Mixed Day schools showed a response rate of 67%, along with a 33% non-response rate. Furthermore, the response rates among Teachers of chemistry mirrored the patterns observed in the principal category. Teachers from Boys and Girls schools displayed a 100% response rate, whereas teachers from Mixed Day schools had a response rate of 67% and a non-response rate of 33%. Examining the data related to students, there were variations in response rates. Students from Boys schools exhibited a

response rate of 60% and a non-response rate of 40%, whereas students from Girls schools displayed a higher response rate of 80% and a lower non-response rate of 20%. Mixed Day schools had the highest response rate among students, with 83%, and a corresponding non-response rate of 17%.

4.2.1 Background characteristics

Respondents were asked to indicate their gender. Their responses are analyzed in the table below.

4.2.1 Gender distribution

The respondents were asked to respond to their Gender

Table 4.2 .2 Gender distribution

Gender	Frequency	Percentage (%)
Males	60	45
Females	74	55
Total	**134**	**100**

Source: Author (2023)

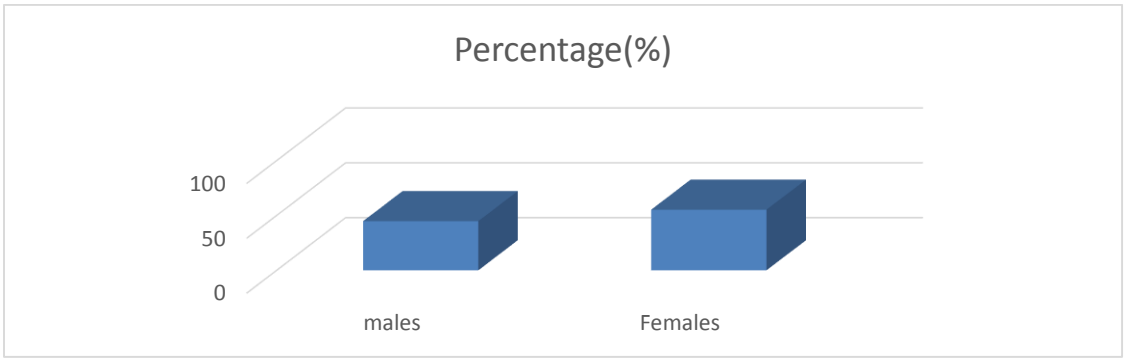


Figure 4.2.2 Gender distribution

Source: Author (2023)

The table 4.2.2 presents the gender distribution of students in relation to factors influencing low achievement in chemistry in public secondary schools in Athi River Sub-County,

Machakos County, Kenya. According to the data, there are a total of 134 students included in the study. Out of these, 60 students (45%) are male, and 74 students (55%) are female. The table indicates that there are slightly more female students (55%) than male students (45%). This distribution is essential to note as it helps to understand the representation of each gender in the study. The gender distribution may have implications for analyzing factors influencing low achievement in chemistry. For instance, if the factors affect male and female students differently, the higher representation of female students might influence the overall findings of the study.

4.2.2 Age of the respondents

Respondents were asked to indicate their Age. The findings are indicated in the Table 4.2.

Table 4:2.3: Age of the respondents

Age	Frequency	Percentages
Below 15	34	25
16-20	80	60
21-25	2	1
26-30	8	6
above 30	10	7
	134	100

Source: Author (2023)

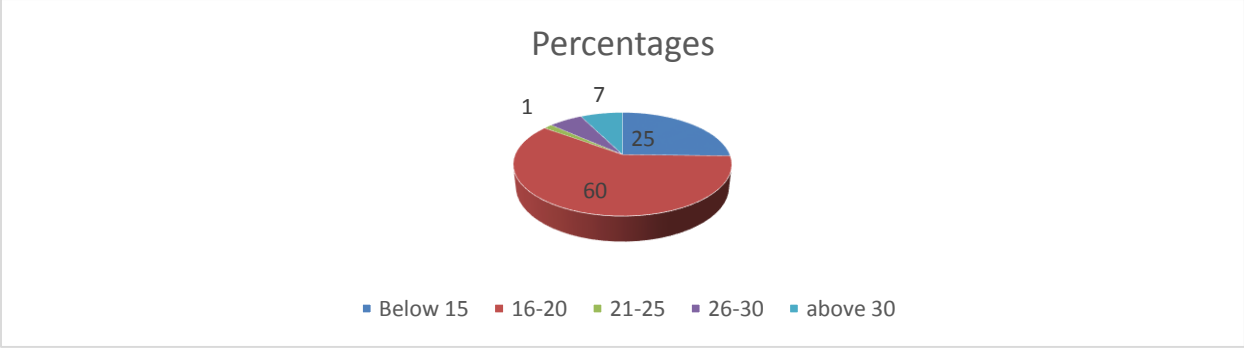


Figure 4.2.3: Age of the respondents

Source: Author (2023)

Table 4.2.3 presents the distribution of respondents' ages in a survey or study. It shows the number of respondents (Frequency) in different age groups and the corresponding percentage of respondents (Percentages) within each age group. There were 34 respondents below the age of 15.80 respondents were between the ages of 16 and 20.Only 2 respondents were between 21 and 25 years old. There were 8 respondents between 26 and 30 years old.10 respondents were above the age of 30.Percentages: This column provides the percentage of respondents in each age group relative to the total number of respondents.:25% of the respondents were below the age of 15.60% of the respondents were between the ages of 16 and 20.Only 1% of the respondents were between 21 and 25 years old. 6% of the respondents were between 26 and 30 years old.7% of the respondents were above the age of 30. The table comprises a total of 134 respondents, and the percentages add up to 100%, which is expected since it represents the entire population of respondents.

4.2.3 Subjects taught

Teachers were asked whether they teach any other subject apart from chemistry. The response is as below. From the total number of 10 teachers the response was as follows

Table 4.2.4 Subjects taught

Category	Frequency	Percentages
YES	8	80
NO	2	20
	10	100

Source: Author (2023)

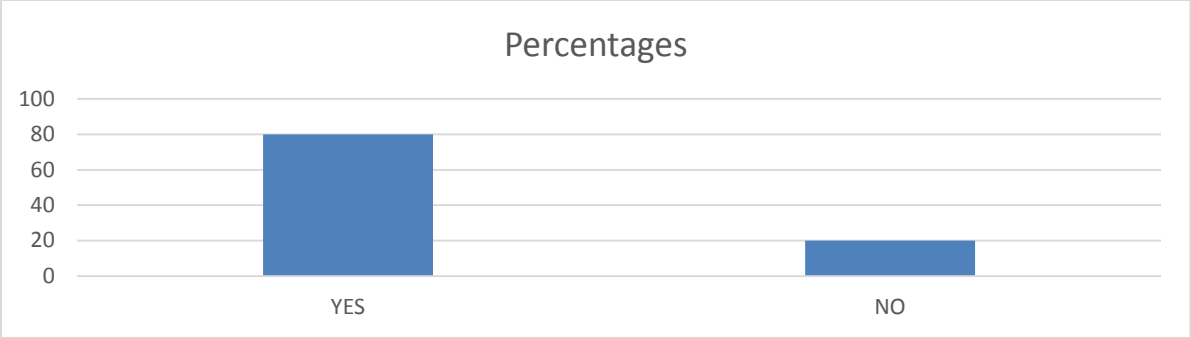


Figure 4.2.4 Subjects Taught

Source: Author (2023)

The data on Table 4.2.4 and Figure 4.2.4 provided shows the responses of 10 teachers when asked whether they teach any subject other than chemistry. The responses are categorized into "YES" and "NO." The majority of the teachers, 8 out of 10, responded "YES" when asked if they teach any other subject apart from chemistry. This represents 80% of the total respondents. Only 2 out of 10 teachers responded "NO," indicating that they solely focus on teaching chemistry. This represents 20% of the total respondents.

The data suggests that a significant portion of the teachers in this study also have responsibilities for teaching other subjects other than chemistry. This could have implications for their workload and the resources they have available to devote to teaching chemistry. Teachers who teach multiple subjects may face challenges in allocating sufficient time and resources specifically for chemistry instruction. On the other hand, the small percentage of teachers who exclusively teach chemistry might have a more focused expertise in the subject.

4.2.5 The Chemistry subject

The study sought to assess the student perception of chemistry subject

Table 4.2.5 The Chemistry subject

Category	Completely concur	concur	Disagree	Disagree vehemently	Undecided	Total
Students from Boys school	1	0	4	1	0	6

Students from Girls School	0	0	1	7	0	8
Students from Mixed Day	5	5	10	20	60	100

Source: Author (2023)

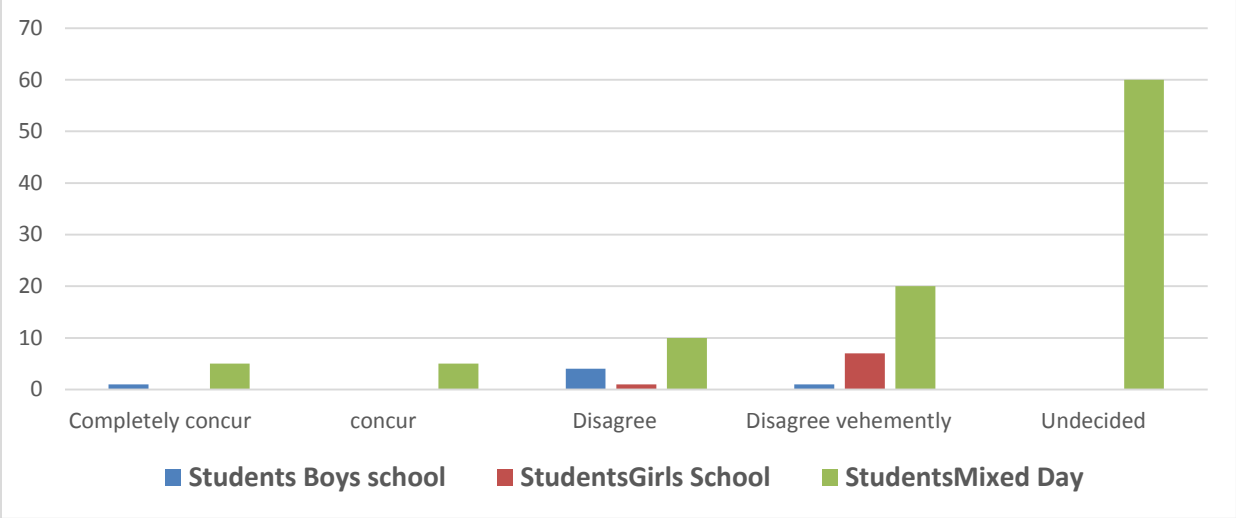


Figure 4.2.5 Chemistry subject

Source: Author (2023)

The data on Table 4.2.5 and figure 4.2.5 provided represents the responses from students on the statement: The responses are categorized into five levels: Completely concur, Concur, Disagree, Disagree vehemently, and Undecided. The table also provides the frequencies for each category, broken down by the type of school the students attend (boy's school, girl's school, and mixed day). Out of the 6 students from boy's school who responded to the statement, 1 completely concurred, 4 disagreed, 1 disagreed vehemently, and none concurred or were undecided. This suggests that the majority of students from boy's school do not find chemistry easier to understand than other science disciplines. Among the 8 students from Girls school who responded, none completely concurred or concurred, 1 disagreed, 7 disagreed vehemently, and none were undecided. This indicates that the majority of students from Girls school strongly disagree that chemistry is easier to understand than other science disciplines. Out of the 100 students from mixed day who responded, 5 completely concurred, 5 concurred, 10 disagreed, 20 disagreed vehemently, and 60 were undecided. This shows a wide range of responses, with a significant portion of students being undecided about whether chemistry is easier to understand than other science disciplines. The data highlights that opinions on the

ease of understanding chemistry compared to other science disciplines vary among students from different types of schools. It indicates that students from boy's school and girl's school generally find chemistry challenging or at least not easier than other science disciplines. On the other hand, among students from mixed day schools, there is a broader spectrum of opinions, including a significant number who are undecided.

4.2. 6 Academic Degree

The study sought to establish the academic degree level of the principals in the schools.

Table 4.2. 6 Academic Degree

Degree level	Frequency	Percentages
Master's Degree	2	20
Bachelor's Degree	4	40
Diploma	4	40
	10	100

Source: Author (2023)

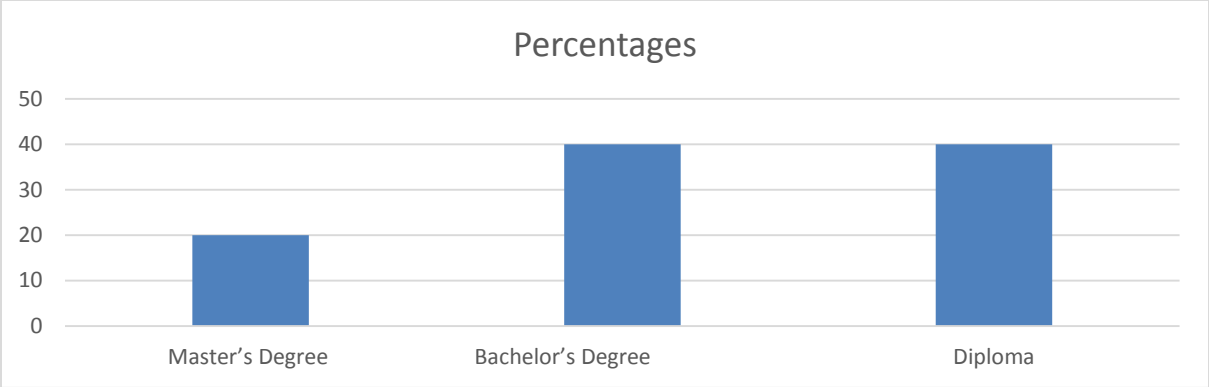


Figure 4.2.6 Academic Degree

The data provided shows the degree levels of school principals in relation to the type of degree they hold. The table includes the frequencies and percentages for each degree level: Master's Degree, Bachelor's Degree, and Diploma. The frequency for Master's Degree level is 2, representing 20% of the total respondents. This suggests that out of the 10 school principals surveyed, 20% of them hold a Master's Degree. The frequency for Bachelor's Degree level is 4, accounting for 40% of the total respondents. This indicates that 40% of the school principals in the study have obtained a Bachelor's Degree. The frequency for Diploma is 4, also representing 40% of the total respondents. This suggests that an equal percentage of school principals in the study possess a Diploma.

From the data, we can observe that the majority of the school principals in the study have a Bachelor's Degree or a Diploma, each accounting for 40% of the sample. Additionally, 20% of the principals have achieved a Master's Degree. The distribution of degree levels among school principals may reflect the requirements and qualifications set by the education system or the specific hiring practices in the region. It is worth noting that while a Master's Degree is typically considered a higher level of education, a significant proportion of principals in this study have a Bachelor's Degree or a Diploma, suggesting that these qualifications are also valued in school leadership roles.

4.2.5 The length of teaching career

Table 4.2.7 Length of teaching career

Length of teaching	Frequency	Percentages
1 to 5	1	10
6 to 10	2	20
11 to 15	5	50
1 to 20	1	10
above 20	1	10
	10	100

Source: Author (2023)

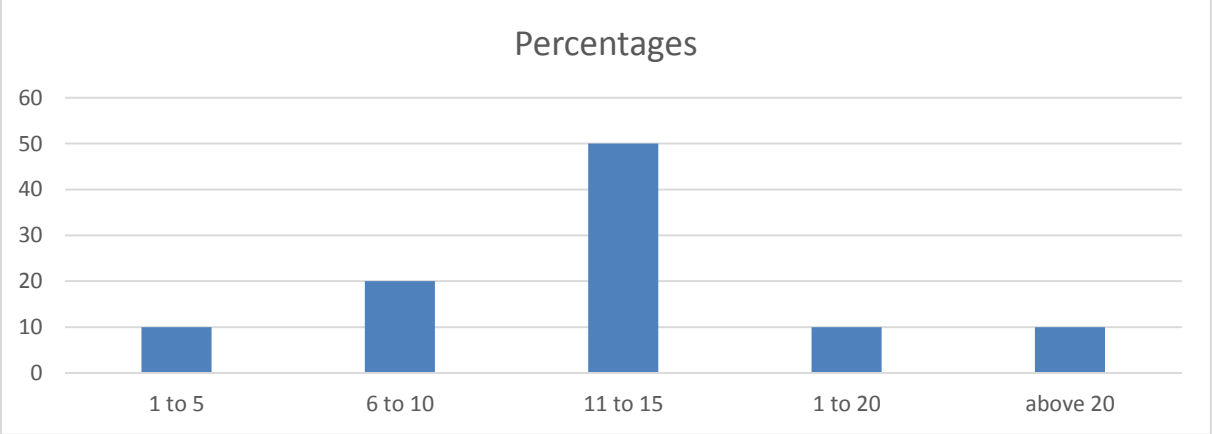


Figure 4.2.7 Length of teaching career

Source: Author (2023)

The data provided represents the length of teaching careers for principals in the study. The table includes the frequencies and percentages for different length categories: 1 to 5 years, 6 to 10 years, 11 to 15 years, 1 to 20 years, and above 20 years. The frequency 1 to 5 years category is 1, representing 10% of the total respondents. This suggests that one principal in the study has been teaching for 1 to 5 years. The frequency for 6 to 10 years category is 2, accounting for 20% of the total respondents. This indicates that two principals in the study have a teaching career ranging from 6 to 10 years. The frequency for this 11 to 15 years

category is 5, representing 50% of the total respondents. This suggests that the majority of principals in the study have been teaching for 11 to 15 years. The frequency for 1 to 20 years category is 1, accounting for 10% of the total respondents. This indicates that one principal in the study has a teaching career ranging from 1 to 20 years. The frequency for above 20 years is 1, also representing 10% of the total respondents. This suggests that one principal in the study has been teaching for more than 20 years.

From the data, it observed that the principals in the study have varied lengths of teaching careers. The largest group of principals falls in the 11 to 15 years category, comprising 50% of the sample. This indicates a relatively experienced group of principals. Additionally, there are principals with shorter teaching careers (1 to 5 years and 6 to 10 years) as well as those with longer teaching careers (1 to 20 years and above 20 years), each accounting for 10% of the sample.

4.2.6 KCSE result

Table 4.2.8 KCSE result

		Mean Score					
	Year	1.0-3.0	3.1-5.0	5.1-7.0	7.1-9.0	Above 9.0	total percentage
Overall KCSE performance	2020	20%	63%	10%	5%	2%	100%
	2021	24%	40%	18%	6%	12%	100%
	2022	25%	30%	21%	10%	14%	100%
KCSE Chemistry	2020	50%	40%	10%	0%	0%	100%
	2021	52%	38%	8%	2%	0%	100%
	2022	23%	55%	14%	4%	45	100%

Source: Author (2023)

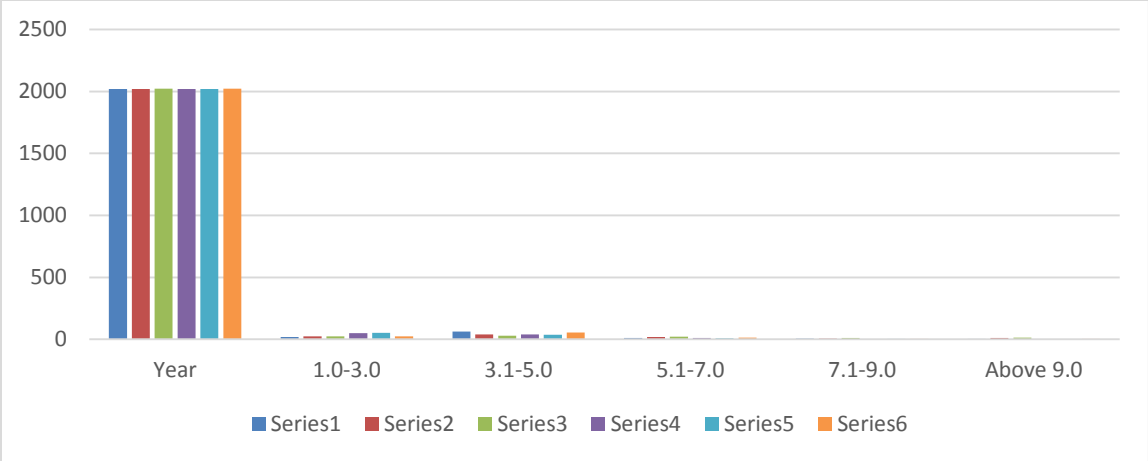


Figure: 4.2.8 KCSE result

Source; Author (2023)

The data provided in Table 4.2.8 compares the KCSE (Kenya Certificate of Secondary Education) results for overall performance and specifically for the subject of Chemistry. The table presents the mean scores and percentages for different score ranges across the years 2020, 2021, and 2022. In 2020, the highest percentage of students (63%) achieved a score range of 3.1-5.0, followed by 20% in the 1.0-3.0 range. In 2021, the highest percentage of students (40%) achieved a score range of 3.1-5.0, followed by 24% in the 1.0-3.0 range. In 2022, the highest percentage of students (30%) achieved a score range of 3.1-5.0, followed by 25% in the 1.0-3.0 range. In 2020, the highest percentage of students (50%) achieved a score range of 1.0-3.0 in Chemistry, followed by 40% in the 3.1-5.0 range. In 2021, the highest percentage of students (52%) achieved a score range of 1.0-3.0 in Chemistry, followed by 38% in the 3.1-5.0 range. In 2022, the highest percentage of students (55%) achieved a score range of 3.1-5.0 in Chemistry, followed by 23% in the 1.0-3.0 range. From the data, we can observe some trends in the performance of students in overall KCSE and specifically in Chemistry.

The majority of students in all three years achieved scores in the 1.0-5.0 range, with varying percentages across the years. There is a slight increase in the percentage of students achieving scores above 9.0 in 2021 and 2022 compared to 2020. The majority of students in all three years achieved scores in the 1.0-5.0 range, with varying percentages across the years. There is a notable increase in the percentage of students achieving scores above 9.0 in 2022 compared to 2020 and 2021.

4.2.7 Individual's impression of chemistry

Table 4.2.9 Individual's impression of chemistry

individual's impression of chemistry	Frequency	Percentages
YES	8	80
NO	2	20
	10	100

Source: Author (2023)

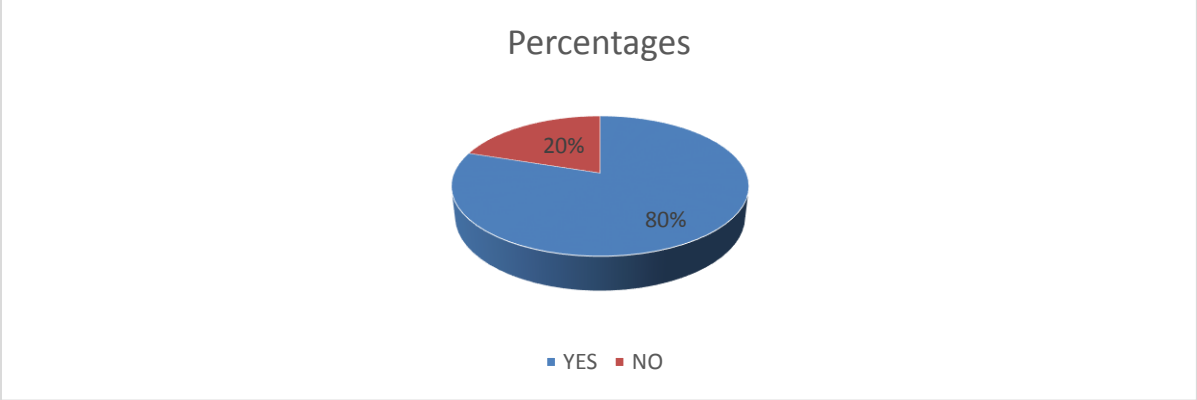


Figure 4.2.9 Individual's impression of chemistry

Source: Author (2023)

The data provided represents individuals' impression of chemistry. The table includes the frequencies and percentages for two categories: "YES" and "NO," indicating whether individuals have a positive or negative impression of chemistry, respectively. Individuals. The frequency for a positive impression (YES) is 8, representing 80% of the total respondents. This suggests that out of the 10 individuals surveyed, 80% of them have a positive impression of chemistry. The frequency for Individuals with a negative impression (NO is 2, accounting for 20% of the total respondents. This indicates that 20% of the surveyed individuals have a negative impression of chemistry. From the data, we can infer that the majority of individuals

surveyed have a positive impression of chemistry, as indicated by the high percentage (80%) in the "YES" category. This suggests that they likely find chemistry interesting, enjoyable, or valuable in some way. On the other hand, a smaller proportion of individuals (20%) have a negative impression of chemistry, implying that they may find it challenging, uninteresting, or unimportant.

4.2.8 Teachers

Table 4.2.10Teachers

Teachers	**Frequency**	**Percentages**
YES	5	50
NO	5	50
	10	**100**

Source: Author (2023)

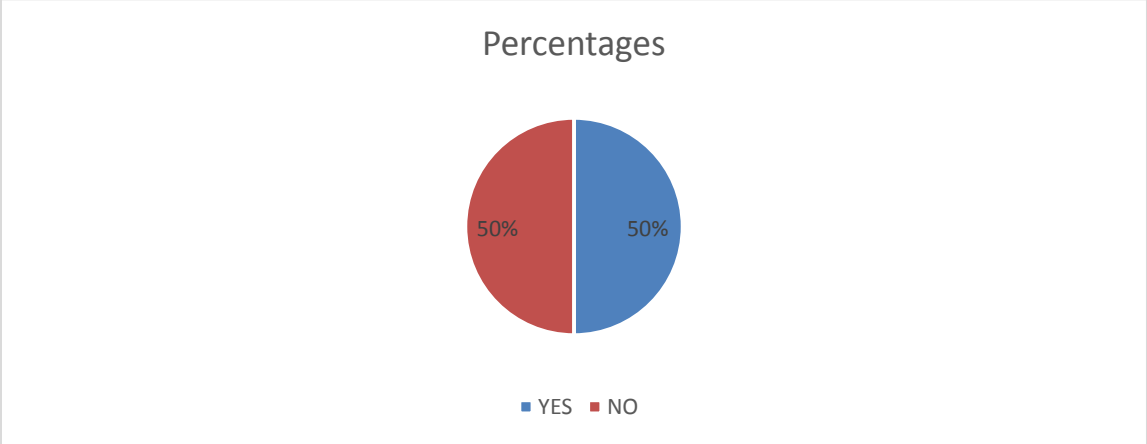


Figure 4.2.10 Teachers

Source: Author (2023)

The data provided represents the adequacy of teachers in the institution to teach chemistry. The table includes the frequencies and percentages for two categories: "YES" and "NO," indicating whether the teachers are considered adequate or not for teaching chemistry, respectively. The frequency for Teachers considered adequate (YES) category is 5, representing 50% of the total

respondents. This suggests that out of the 10 individuals surveyed, 50% of them consider the teachers at the institution to be adequate for teaching chemistry. The frequency for teachers considered is inadequate (NO): is also 5, accounting for the remaining 50% of the total respondents. This indicates that the other 50% of the surveyed individuals do not consider the teachers at the institution to be adequate for teaching chemistry.

From the data, we can infer that the opinions regarding the adequacy of teachers at the institution to teach chemistry are equally divided among the surveyed individuals. Half of the respondents perceive the teachers to be adequate, while the other half holds the view that they are inadequate.

4.2.9 Amount of Work

Table 4.2.11 Amount of Work

Amount of work	Frequency	Percentages
Heavy	3	30
Moderate	5	50
Low	2	20
	10	**100**

Source: Author (2023)

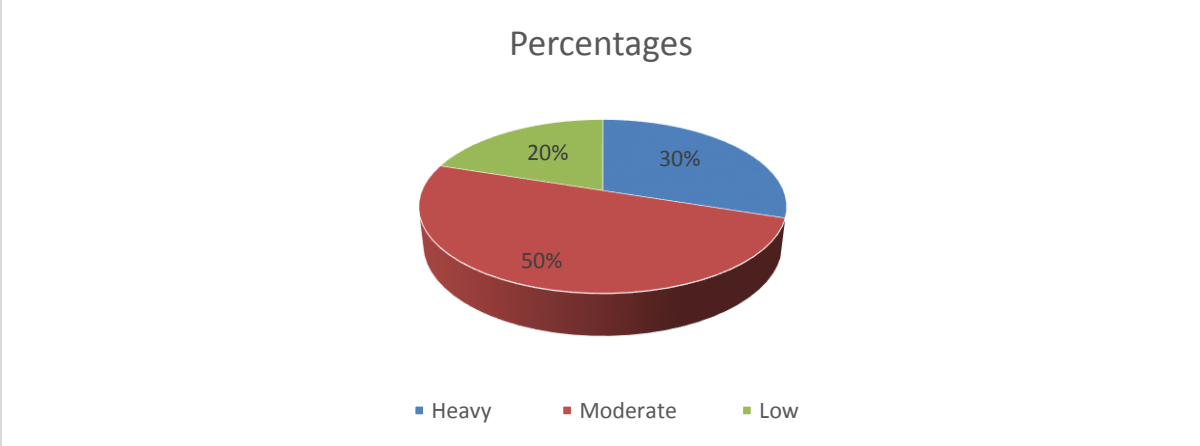


Figure 4.2.11 Amount of Work

Source: Author (2023)

The data provided represents the amount of work perceived by the school principal. The table includes the frequencies and percentages for three categories: "Heavy," "Moderate," and "Low," indicating the level of workload experienced by the principals. The frequency for Heavy workload is 3, representing 30% of the total respondents. This suggests that out of the 10 principals surveyed, 30% of them perceive their workload as heavy. The frequency for Moderate workload is 5, accounting for 50% of the total respondents. This indicates that the majority of the surveyed principals, 50%, consider their workload to be at a moderate level. The frequency for Low workload is 2, representing 20% of the total respondents. This implies that 20% of the surveyed principals perceive their workload as low.

From the data, we can infer that principals' perceptions of their workload vary among the respondents. The majority of principals, 50%, consider their workload to be at a moderate level. A significant portion, 30%, perceive their workload as heavy, indicating a higher level of responsibilities and tasks. A smaller proportion, 20%, perceive their workload as low, implying that they may have fewer tasks or a less demanding schedule compared to others.

4.2.10 Length of Time

Table 4.2.12 Length of Time

Amount of work	Frequency	Percentages
1 to 4	2	20
5 to 8	2	20
9 to 12	4	40
13 to 16	1	10
over 16	1	10
	10	100

Source: Author (2023)

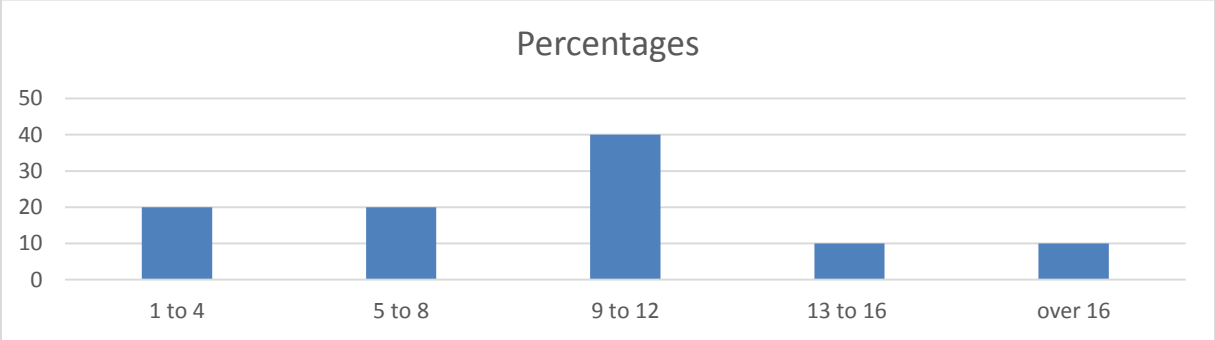


Figure 4.2.12 Length of Time

Source: Author (2023)

The data provided represents the typical length of time spent as teachers of chemistry. The table includes the frequencies and percentages for different time ranges, ranging from 1 to 4 years to over 16 years. The frequency for Teachers with 1 to 4 years of experience is 2, representing 20% of the total respondents. This suggests that out of the 10 teachers surveyed, 20% of them have been teaching chemistry for 1 to 4 years. The frequency for Teachers with 5 to 8 years of experience is also 2, accounting for 20% of the total respondents. This indicates that another 20% of the surveyed teachers have been teaching chemistry for 5 to 8 years. The frequency for Teachers with 9 to 12 years of experience is 4, representing 40% of the total respondents. This suggests that the majority of the surveyed teachers, 40%, have been teaching chemistry for 9 to 12 years. The frequency for Teachers with 13 to 16 years of experience is 1, accounting for 10% of the total respondents. This indicates that 10% of the surveyed teachers have been teaching chemistry for 13 to 16 years. The frequency for this Teachers with over 16 years of experience is also 1, representing 10% of the total respondents. This suggests that another 10% of the surveyed teachers have been teaching chemistry for over 16 years. From the data, we can infer that the teachers surveyed have varying levels of experience in teaching chemistry. The majority of teachers, 40%, have been teaching for 9 to 12 years, indicating a relatively experienced group. There is also a relatively even distribution across other time ranges, with 20% of teachers falling into each of the 1 to 4 years, 5 to 8 years, 13 to 16 years, and over 16 years categories.

4.2.11 Teacher attendance to professional development sessions

Table 4.2.13 Teacher attendance to professional development sessions

Attendance	**Frequency**	**Percentages**
Often	6	60
Moderate	4	40
Rarely	0	0
Not at all	0	0
	10	100

Source: Author (2023)

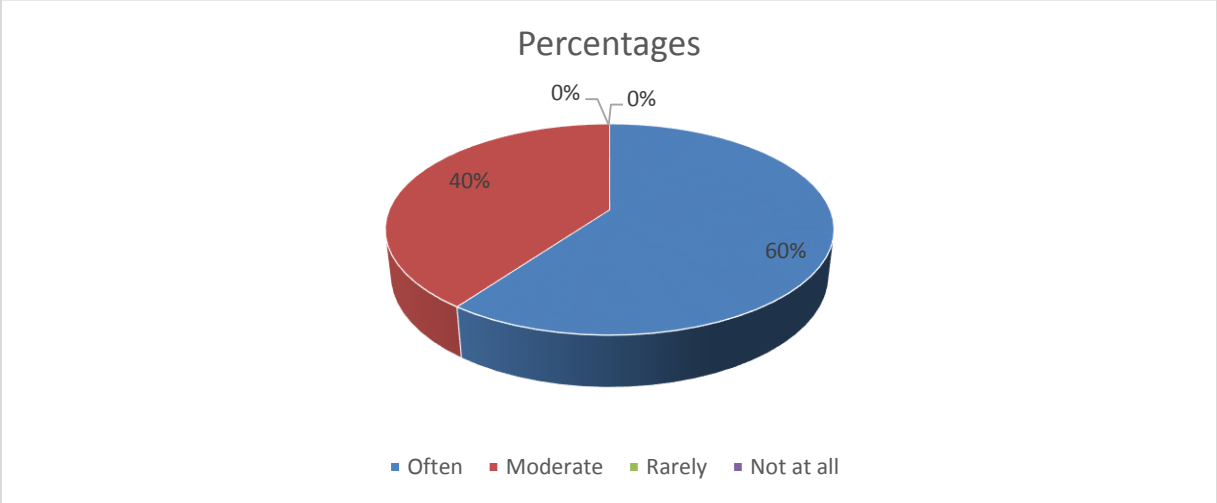


Figure 4.2.13 Teacher attendance to professional development sessions

Source: Author (2023)

The data provided represents the attendance of teachers of chemistry at professional development sessions, seminars, or workshops each year. The table includes the frequencies and percentages for four categories: "Often," "Moderate," "Rarely," and "Not at all," indicating the frequency of attendance.

The frequency for this category is 6, representing 60% of the total respondents. This suggests that out of the 10 teachers surveyed, 60% of them attend professional development sessions

often. Teachers who attend professional development sessions moderately: The frequency for this category is 4, accounting for the remaining 40% of the total respondents. This indicates that the other 40% of the surveyed teachers attend professional development sessions moderately.

From the data, we can infer that the majority of the surveyed teachers of chemistry attend professional development sessions often, with 60% falling into this category. This indicates a proactive approach to professional growth and a commitment to continuous learning and improvement. Attending professional development sessions provides teachers with opportunities to enhance their subject knowledge, instructional techniques, and familiarity with the latest educational practices and research findings.

Additionally, 40% of the teachers attend professional development sessions moderately. Although this proportion is smaller, it still indicates a significant number of teachers who actively seek professional development opportunities to improve their teaching skills and stay updated with advancements in the field of chemistry education.

4.2.13 The Academic Standing and Teaching Background Of Teachers of chemistry

Table 4.2.14 The Academic Standing and Teaching Background of Teachers of chemistry

		1	2	3	4	5
Academic Qualification level	Masters	27%	43%	10%	10%	10%
	Degree	70%	30%	0%	0%	0%
	Diploma	50%	50%	0%	0%	0%
	Untrained	0%	0%	0%	6%	92%
Teaching experience in years	1 to 4	20%	50%	30%	0%	0%
	5 to 8	20%	30%	50%	0%	0%
	9 to 13	50%	50%	0%	0%	0%
	13 to 16	40%	50%	10%	0%	0%
	Above 16	20%	30%	50%	0%	0%

Source: Author (2023)

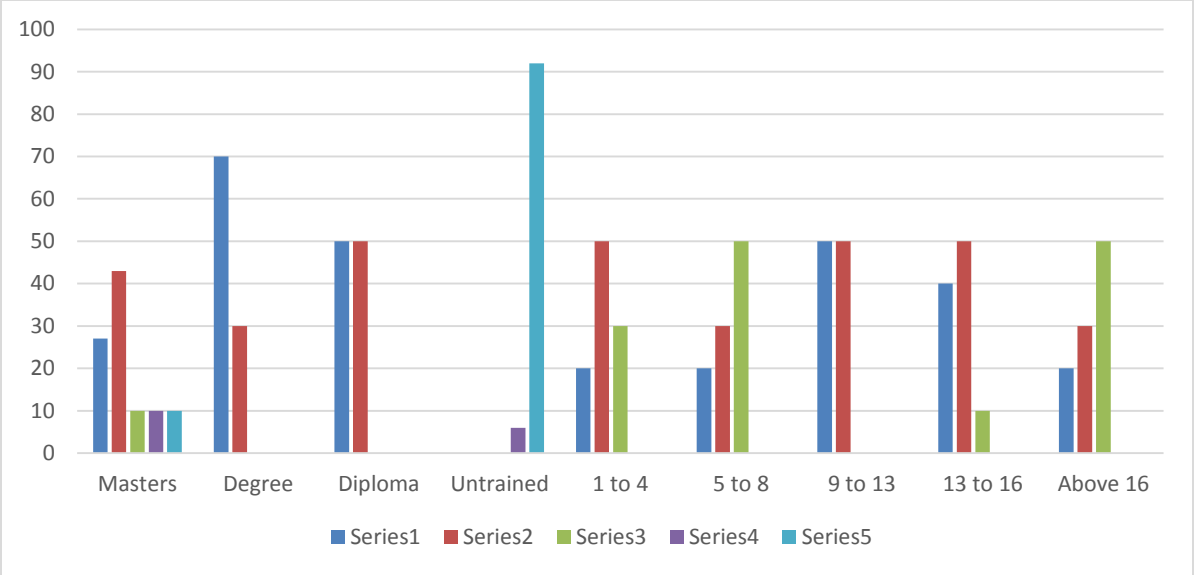


Figure 4.2.14 the academic standing and teaching background of teachers of chemistry

Source: Author (2023)

On the question whether Masters Qualification affect performance in chemistry subject the response was 27% strongly agree, 43% agree, 10% disagree, 10% strongly disagree, and 10% neither agree nor disagree. On the question whether degree qualification affect performance in chemistry subject 70% strongly agree, 30% agree, and 0% disagree, strongly disagree, or neither agree nor disagree. On the question whether Diploma qualification affect performance in chemistry subject 50% strongly agree, 50% agree, and 0% disagree, strongly disagree, or neither agree nor disagree. On the question whether those untrained in teaching affect performance in chemistry subject 0% strongly agree, 0% agree, 0% disagree, 6% strongly disagree, and 92% neither agree nor disagree. That 1 to 4 years teaching experience, affect performance in chemistry subject 20% strongly agree, 50% agree, 30% disagree, and 0% strongly disagree or neither agree nor disagree. That 4 to 5 years teaching experience, affect performance in chemistry subject 20% strongly agree, 30% agree, 50% disagree, and 0% strongly disagree or neither agree nor disagree. That 9 to 13 years teaching experience, affect performance in chemistry subject the response is 50% strongly agree, 50% agree, and 0% disagree, strongly disagree, or neither agree nor disagree. That 13 to 16 years teaching experience, affect performance in chemistry subject response was 40% strongly agree, 50% agree, 10% disagree, and 0% strongly disagree or neither agree nor disagree, while above 16 years: teaching experience affect performance in chemistry subject 20% strongly agree, 30%

agree, 50% disagree, and 0% strongly disagree or neither agree nor disagree. The findings presented indicate significant differences in the responses of two age groups (13 to 16 years and above 16 years) to a particular survey question or statement. The implications of these findings can be far-reaching and can have positive implications, on students' low achievement in chemistry in public secondary schools in Athi River Sub- County.

Table 4.2.15 Success in Chemistry

	Frequency	Percentages
YES	8	80
NO	2	20
	10	100

Source: Author (2023)

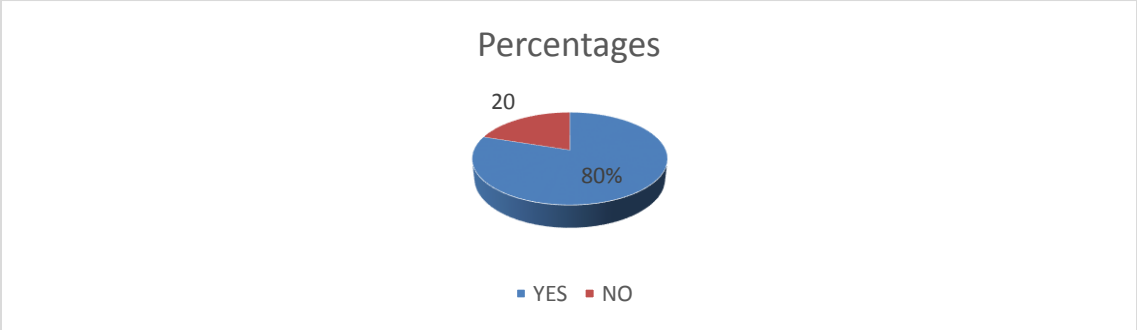


Table 4.2.15 Success in Chemistry

Source: Author (2023)

Based on the provided data, we can interpret the following in relation to students' success in chemistry being influenced by the academic credentials of their teachers. Among the surveyed students, 80% of them responded "YES" when asked about their success in chemistry. 20% of the students responded "NO" when asked about their success in chemistry. Based solely on this limited data, it suggests that a majority (80%) of the students reported success in chemistry. However, without further information on the academic credentials of their teachers, we cannot directly attribute this success to their qualifications. Other factors such as teaching methods, student engagement, and individual effort can also play significant roles in students' success in chemistry.

4.2.15 Availability of Resources

The respondents were asked to indicate whether they agree on disagree on the following statement relation for availability of resources in school. This was measured using a Likert Scale, where (1 Strongly Agree, 2 Agree, 3 Not Sure, 4 Disagree and 5 strongly Disagree)

Table 4.2.16 Availability of Resources

Statement	1	2	3		4	5
The accessibility of ICT facilities and teaching/learning materials	64	8	9	10	8	1
A computer lab with adequate functional computers is available.	30	20	5	7	10	28
I make sure teachers of chemistry go to ICT meetings and classes when requested.	65	23	8	0	4	**0**
The availability of chemistry CDs and e-Books for teachers is acceptable.	0	0	6	53	9	32
I make sure there are enough chemical books for various modes of instruction.	52	12	7	12	7	10
I provide teachers and students with enough chemistry revision papers and booklets.	30	20	5	7	10	28
All courses have access to sufficient chemical laboratories.	65	23	8	0	4	**0**
To complete biochemistry practicums, there are sufficient chemicals and equipment.	45	30	12	5	3	5
There are sufficient libraries and classrooms for instruction and test preparation.	30	20	5	7	10	28
The right diagrams and models are available to teach chemistry.	65	23	8	0	4	**0**
Utilization of ICT resources and instructional tools	30	20	5	7	10	28
ICT resources can be used to teach chemistry by qualified teachers of chemistry.	52	12	7	12	7	10
I make sure that teachers of chemistry use ICT, including CDs and computers, when teaching the subject.	65	23	8	0	4	0

I make sure students use their textbooks and study guides to make sure they are adequately prepared for tests.	30	20	5	7	10	28
For better comprehension, I make sure chemical practicals are performed often.	22	38	20	10	5	5
To help students grasp what they are learning, teachers of chemistry utilize models and charts throughout class.	30	20	5	7	10	28
Students adequately utilize the classroom and library for review to boost their confidence before chemistry tests.	65	23	8	0	4	0

Source: Author (2023)

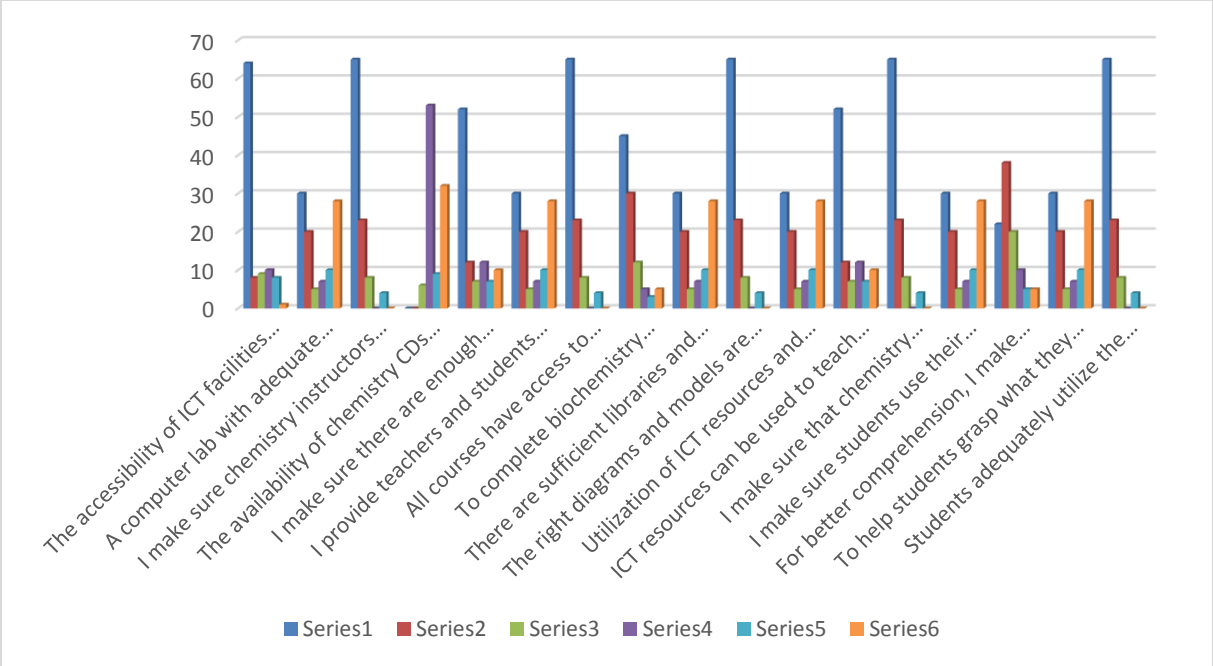


Figure 4.2.16 Availability of Resources

Source: Author (2023)

Tables 4.2.16 shows the relation to the availability of resources and how they are used in the school. On the accessibility of ICT facilities and teaching/learning materials response was 64% strongly agree, 8% agree, 9% disagree, 10% strongly disagree, and 8% neither agree nor disagree. On a computer lab with adequate functional computers is available 30% strongly

agree, 20% agree, 5% disagree, 7% strongly disagree, and 28% neither agree nor disagree. That teacher sure teachers of chemistry go to ICT meetings and classes when requested 65% strongly agree, 23% agree, 8% disagree, 0% strongly disagree, and 4% neither agree nor disagree. On that availability of chemistry CDs and e-Books for teachers is acceptable: response was 0% strongly agree, 0% agree, 6% disagree, 53% strongly disagree, and 9% neither agree nor disagree. On that the principal is make sure there are enough chemical books for various modes of instruction response was 52% strongly agree, 12% agree, 7% disagree, 12% strongly disagree, and 7% neither agree nor disagree. On that, the principals provide teachers and students with enough chemistry revision papers and booklets response was 30% strongly agree, 20% agree, 5% disagree, 7% strongly disagree, and 28% neither agree nor disagree.

That all courses have access to sufficient chemical laboratories 65% strongly agree, 23% agree, 8% disagree, 0% strongly disagree, and 4% neither agree nor disagree. That to complete biochemistry practicums, there are sufficient chemicals and equipment 45% strongly agree, 30% agree, 12% disagree, 5% strongly disagree, and 3% neither agree nor disagree. That there are sufficient libraries and classrooms for instruction and test preparation response is 30% strongly agree, 20% agree, 5% disagree, 7% strongly disagree, and 28% neither agree nor disagree. That, there are right diagrams and models available to teach chemistry 65% strongly agree, 23% agree, 8% disagree, 0% strongly disagree, and 4% neither agree nor disagree.

On utilization of ICT resources and instructional tools repose was 30% strongly agree, 20% agree, 5% disagree, 7% strongly disagree, and 28% neither agree nor disagree. That ICT resources can be used to teach chemistry by qualified teachers of chemistry' response as was 52% strongly agree, 12% agree, 7% disagree, 12% strongly disagree, and 7% neither agree nor disagree. That the principal make sure that teachers of chemistry use ICT, including CDs and computers, when teaching the subject the response was 65% strongly agree, 23% agree, 8% disagree, 0% strongly disagree, and 4% neither agree nor disagree. That the students use their textbooks and study guides to make sure they are adequately prepared for tests 30% strongly agree, 20% agree, 5% disagree, 7% strongly disagree, and 28% neither agree nor disagree. That for better comprehension, I make sure chemical practicals are performed often response was 22% strongly agree, 38% agree, 20% disagree, 10% strongly disagree, and 5% neither agree nor disagree. That students grasp what they are learning, teachers of chemistry utilize

models 30% strongly agree, 20% agree, 5% disagree, 7% strongly disagree, and 28% neither agree nor disagree that students adequately utilize the classroom and library for review to boost their confidence before chemistry tests 65% strongly agree, 23% agree, 8% disagree, 0% strongly disagree, and 4% neither agree nor disagree.

These interpretations suggest that, according to the respondents, teachers of chemistry make use of models and charts to aid student understanding, and students actively utilize the classroom and library for review before chemistry tests. However, it's important to note that these interpretations are based on the provided data and reflect the opinions of the respondents. Actual practices and student behaviors may vary.

4.2.16 Student's Performance

The respondents were asked to indicate whether they agree on disagree on the following statement in relation to students' Chemistry performance in the school. This was measured using a Likert Scale, where (1 Strongly Agree, 2 Agree, 3 Not Sure, 4 Disagree and 5 strongly Disagree)

Table 4.2.17 Student's Performance

	yes	no
Learners do better on chemistry exams when ICT resources are used in the classroom?	55	45
A laboratory technician is essential for improving students' performance in chemistry exams	71	29
Laboratory staff members must get training and certification in order to impact students' performance on chemistry exams	91	9

Source: Author (2023)

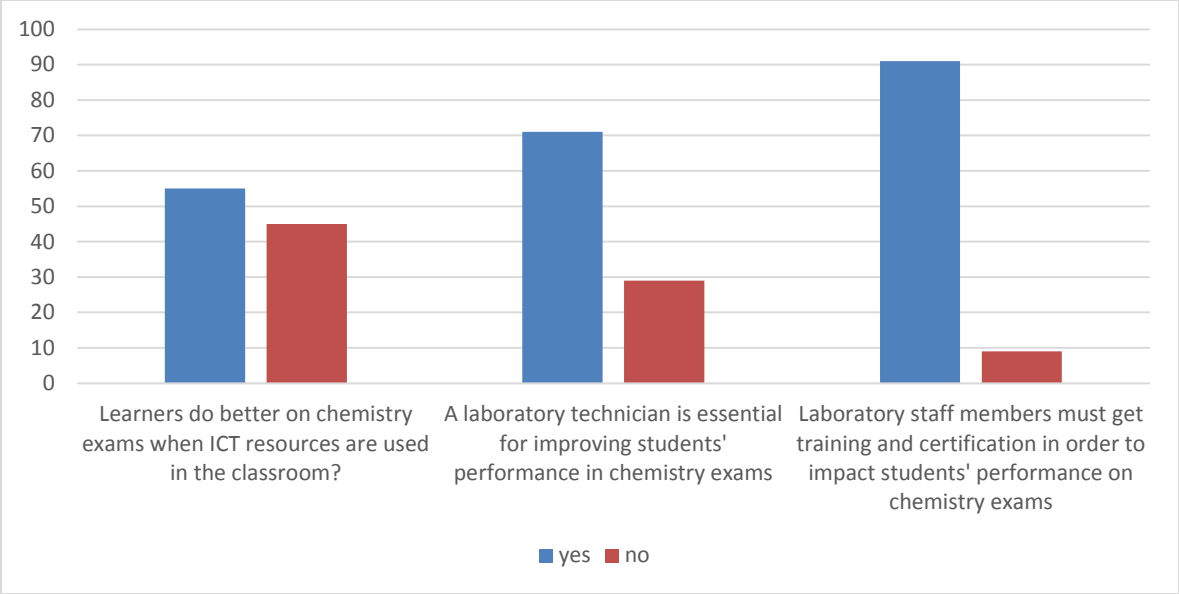


Figure 4.2.16 Student's performance

Source: Author (2023)

Table and figure 4.2.16 shows response on Student's performance in relations to resource available. On that learners do better on chemistry exams when ICT resources are used in the classroom 55% of respondents answered "yes" and 45% answered "no." A majority of respondents (55%) believe that learners perform better on chemistry exams when ICT resources are utilized in the classroom. However, it is worth noting that a significant portion (45%) disagrees with this statement. This difference in opinion suggests a diversity of perspectives on the impact of ICT resources on student performance in chemistry exams. The data shows a divided opinion on the effectiveness of ICT resources in improving students' performance in chemistry exams. This indicates that there may be varying experiences or perceptions regarding the benefits of integrating ICT tools in the chemistry classroom. Further investigation and research can help identify the specific factors that contribute to the differing viewpoints.

On that a laboratory technician is essential for improving students' performance in chemistry exams 71% of respondents answered "yes" and 29% answered "no."The majority of respondents (71%) believe that a laboratory technician is essential for enhancing students' performance in chemistry exams. Meanwhile, 29% of respondents hold the opposing view. Data suggests a strong consensus among respondents that having a laboratory technician is crucial for improving students' performance in chemistry exams. This viewpoint emphasizes

the importance of having dedicated support personnel in the laboratory to provide assistance, guidance, and ensure the smooth functioning of practical experiments and activities. On that laboratory staff members must get training and certification in order to impact students' performance on chemistry exams the response was 91% of respondents answered "yes" and 9% answered "no."

4.2.17 Laboratory technician is essential in improving students' performance in chemistry exams

The school principals were asked whether laboratory technician is essential for improving students' performance in chemistry exams and their response was as follows:-

Table 4.2.17 A laboratory technician is essential in improving students' performance in chemistry exams

Categories	Frequency	Percentages
YES	8	80%
NO	2	20%
	10	100%

Source: Author (2023)

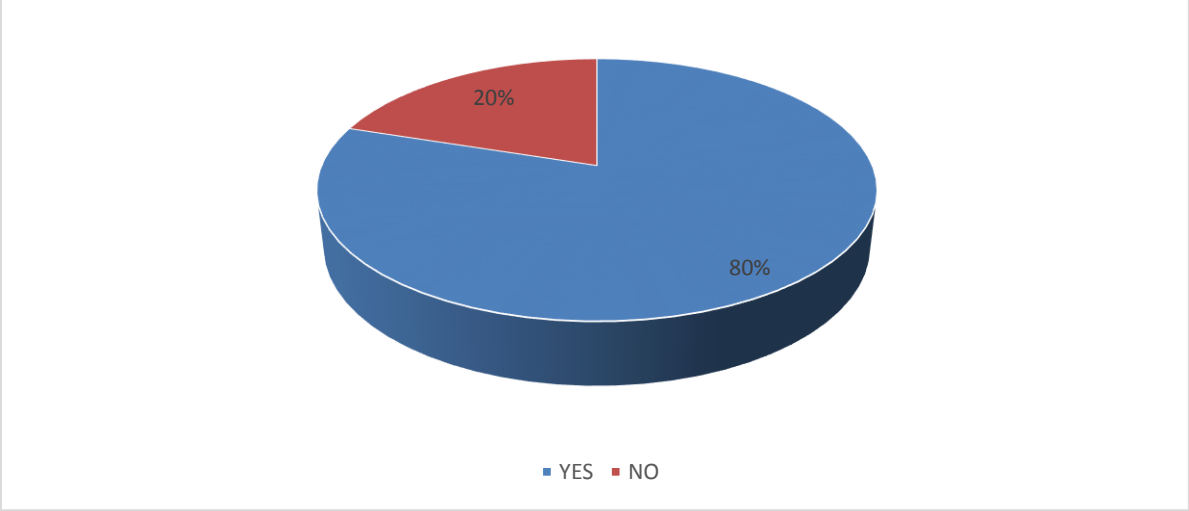


Figure 4.2.17 A laboratory technician is essential for improving students' performance in chemistry exams

Source: Author (2023)

Based on the response from school principals regarding whether a laboratory technician is essential for improving students' performance in chemistry exams, the data shows that 80% of the respondents answered "YES" while 20% answered "NO." The fact that 80% of the principals answered "YES" suggests a strong belief that a laboratory technician is indeed essential for improving students' performance in chemistry exams. This could imply that they recognize the importance of hands-on practical experience and experimentation in the field of chemistry. They may believe that having a dedicated professional to manage and assist with laboratory activities can enhance students' understanding of the subject and their overall performance in exams.

On the other hand, the 20% who responded "NO" may have a different perspective. Their dissenting opinion could indicate that they prioritize other factors or teaching methods over the presence of a laboratory technician. They may believe that effective teaching strategies, theoretical knowledge, and classroom instruction are sufficient to improve students' performance in chemistry exams, without the need for a dedicated technician.

4.2.18 Teachers Liking of Chemistry

The study sought to find out if teachers like teaching chemistry subject in secondary schools.

Table 4.2. 18 Teachers Liking of Chemistry

Categories	Frequency	Percentages
Significantly	5	50%
Modest	4	40%
Not much Absolute	1	10%
	10	100

Source: Author (2023)

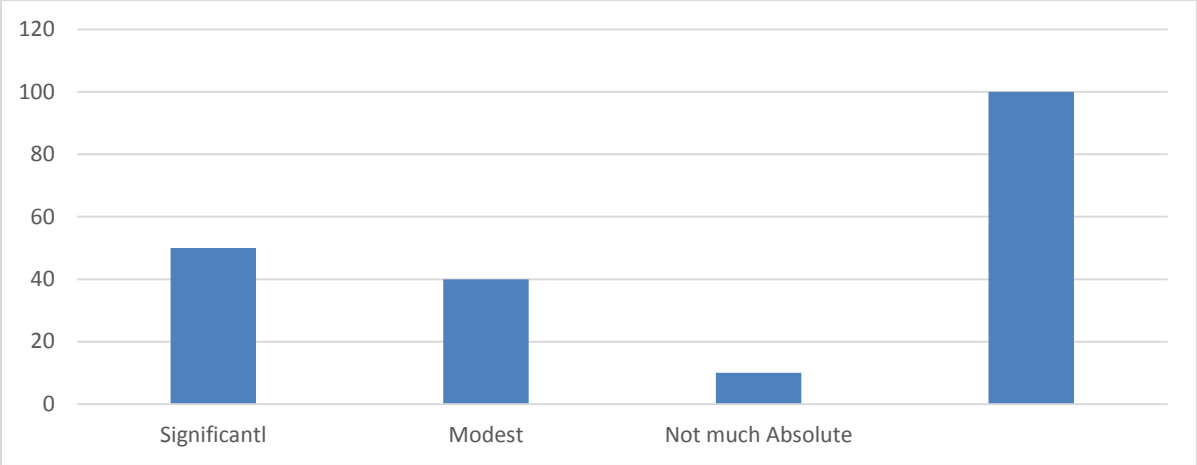


Figure 4.1.18 Do you particularly like Chemistry

Source: Author (2023)

According to Table 4.2.18 and figure 4.2.18 of the study aimed to investigate whether teachers enjoy teaching the subject of chemistry in secondary schools. The table presents the responses from the participants in terms of their liking for chemistry, categorized into three groups: "Significantly," "Modest," and "Not much Absolute."

The data reveals that 50% of the teachers responded with "Significantly" as their liking for teaching chemistry. This indicates that half of the participants have a strong affinity for the subject and genuinely enjoy teaching it. These teachers may possess a deep passion for chemistry and find great satisfaction in sharing their knowledge and enthusiasm with their students.

Additionally, 40% of the respondents expressed a "Modest" liking for chemistry. This suggests that they have a moderate level of interest and enjoyment in teaching the subject. They might not have the same level of enthusiasm as the teachers in the "Significantly" category, but they still possess a reasonable level of fondness for teaching chemistry.

Only 10% of the teachers responded with "Not much Absolute." This implies that a small minority of participants indicated a low level of liking or interest in teaching chemistry. These teachers might have personal preferences for other subjects or find chemistry more challenging or less engaging compared to other subjects that they teach.

4.2.19 Chemistry Topics

The respondents were asked to indicate whether they agree on disagree on the following statement relation topics in Chemistry in school. This was measured using a Likert Scale, where (1 Strongly Agree, 2 Agree, 3 Not Sure, 4 Disagree and 5 strongly Disagree)

Table 4.2.19 Chemistry topics

Chemistry topics	Frequency	Percentages
Teachers of chemistry	8	80%
Other	2	20%
	10	**100%**

Source: Author (2023)

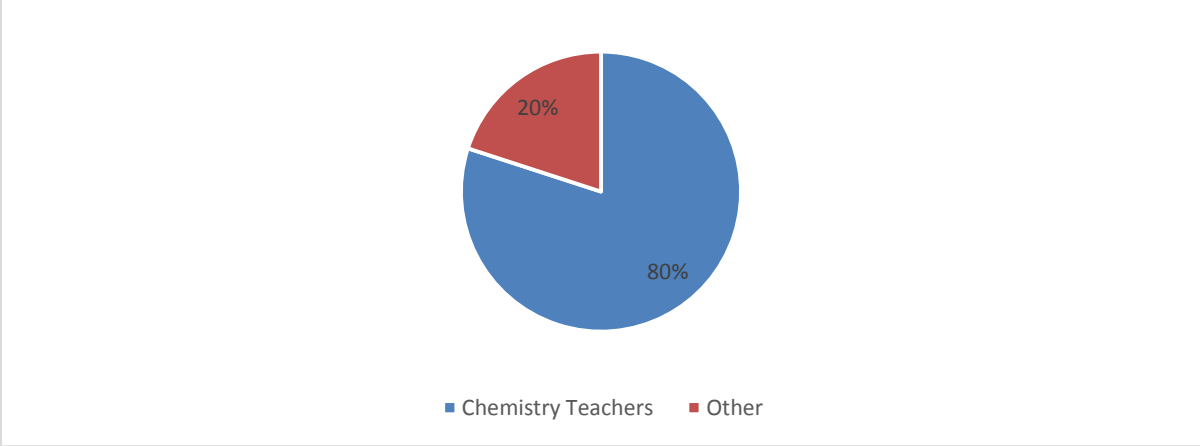


Figure 4.2.19 Chemistry Topics

Source: Author (2023)

Based on the given table, it appears that there were 10 respondents in total who provided feedback on chemistry topics. Out of these respondents, 8 of them were teachers of chemistry, which accounts for 80% of the total responses. The remaining 2 respondents, representing 20% of the total, were categorized as "Other." This table provides information about the distribution of respondents based on their role or profession in relation to the chemistry subject. It suggests

that the majority of the feedback came from teachers of chemistry, indicating that their perspectives and opinions are more prevalent in this dataset

4.2.20 Science Subjects

The teacher were asked to respond on science subjects thought. The response was as follows

Table 4.2.20 Science Subjects

	Frequency	Percentages
Biology	3	30
Physics	3	30
Chemistry	4	40
	10	100

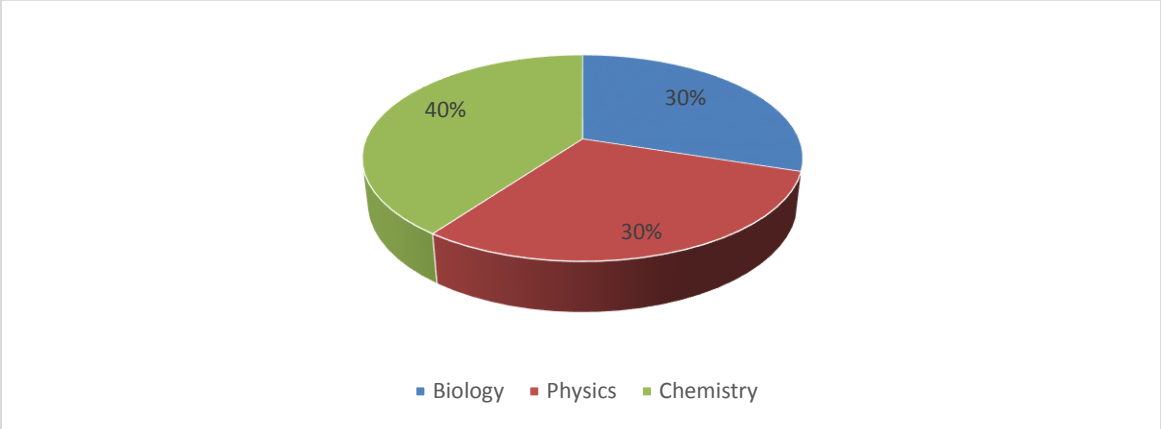


Figure 4.2.20 Science Subjects

Source: Author (2023)

Teachers were asked to respond regarding the subjects they taught. The table shows the frequency and percentages of responses for three subjects: Biology, Physics, and Chemistry. Out of the total 10 responses, Biology and Physics each received 3 responses, which accounts for 30% of the total responses. Chemistry, on the other hand, received 4 responses, representing 40% of the total.

From this information, we can infer that among the teachers who responded, there were equal numbers of teachers teaching Biology and Physics. This suggests that these two subjects are equally represented in the teaching community based on the given data. Chemistry, however,

had a slightly higher number of teachers compared to Biology and Physics, indicating that it may have a relatively higher representation in the teaching community.

4.2.21 Teaching Chemistry influences the Performance in the Chemistry Exam

My understanding of chemistry influences how I perform on the chemistry exam

Table: 4.2.21 Ways in which teaching Chemistry influences the Performance in the Chemistry Exam

	Frequency	Percentages
Wholeheartedly concur	4	40
concur	2	20
disapprove	1	10
vehemently dispute	3	30
Uncertain	0	0
	10	100

Source: Author (2023)

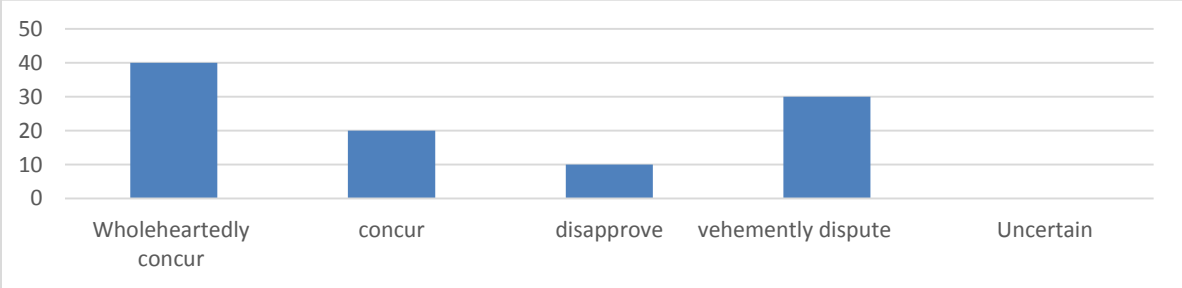


Table: 4.2.21 Ways in which teaching Chemistry Influences Performance in the Chemistry Exam

Source: Author (2023)

Teachers were asked about their understanding of chemistry and how it influences students' performance on the chemistry exam. The table 4.2.21 provides the frequency and percentages of responses. Out of the total 10 responses, 4 teachers "wholeheartedly concur" with the notion that understanding chemistry positively influences students' performance on the exam. This represents 40% of the total responses. Additionally, 2 teachers "concur" with this idea, accounting for 20% of the responses. On the other hand, 1 teacher "disapproves" of the notion, indicating that they believe understanding chemistry does not significantly impact students' performance on the exam. This represents 10% of the responses.

Furthermore, 3 teachers "vehemently dispute" the idea, suggesting that they strongly disagree with the notion that understanding chemistry has a positive influence on students' exam performance. This accounts for 30% of the responses. It's important to note that no teacher selected the option "Uncertain" in response to the question. Based on these responses, it appears that the majority of teachers either strongly agree or agree with the statement that understanding chemistry has a positive influence on students' performance on the chemistry exam. However, a notable portion of teachers (40%) either disagree or strongly disagree with this idea.

4.2.22 Registered Students in School for chemistry exams

The teacher were asked to indicate the number of students registered in School for chemistry exams. The response was as follows**.**

Table 4.2.22 Registered Students in School

No. of Students	Frequency	Percentages
Girls boarding School	2	20%
Mixed day School	3	30%
Mixed Boarding School	3	30%
Boys Boarding school	2	20%
	10	100%

Source: Author (2023)

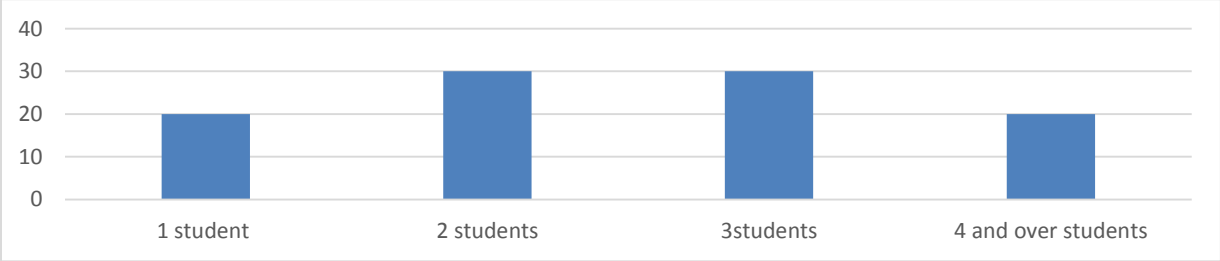


Table 4.2.22 Registered Students in School

Source: Author (2023)

Table 4.2.22 presents valuable insights into the distribution of chemistry exam registrations among various school types, as reported by the participating teachers. Each school type's

contribution to the total number of registered students is expressed both in absolute numbers and as a percentage of the overall count. In Girls Boarding School, there were 2 registered students, constituting 20% of the total. Similarly, Mixed Day School had 3 students, representing 30% of the overall count. Mixed Boarding School also had 3 registered students, contributing another 30% to the total. Lastly, Boys Boarding School had 2 registered students, making up 20% of the total count.

This breakdown not only provides a clear understanding of the number of registered students within each school category but also demonstrates the proportional distribution of chemistry exam registrations across the diverse school types under study. These percentages highlight the relative representation of each school type in the overall dataset, providing valuable information for further analysis and interpretation of the research findings.

4.2.23 Overall Exam Performance

Table: 4.2.23 Overall Exam Performance

No. of Students	Frequency	Percentages
Very good	5	50%
Good	1	10%
Average	1	10%
Poor	2	20%
Very poor	1	10%
	10	100%

Source: Author (2023)

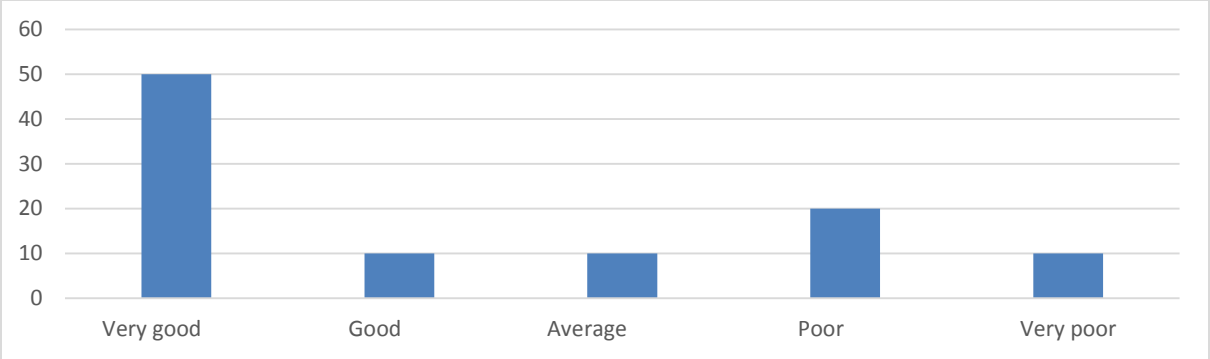


Figure: 4.2.23 Overall Exam Performance

Source: Author (2023)

Table 4.2.23, titled "Overall Exam Performance provides a comprehensive overview of the teacher-reported exam performance of students, with a particular focus on the distribution of student performance across different categories. 5 students are reported to have performed "Very good," 1 student "Good," 1 student "Average," 2 students "Poor," and 1 student "Very poor.", 50% of students are categorized as "Very good," 10% as "Good," 10% as "Average," 20% as "Poor," and 10% as "Very poor."

This information can be instrumental in identifying areas of strength and weakness in the educational system, guiding interventions to improve students' performance, and informing educational policies and practices. Additionally, it offers valuable insights for further analysis and research within the context of the study conducted by the author in 2023.

4.2.24 Science Curriculum in the School

Table 4.2.24 Science Curriculum in the School

No. of Students	Frequency	Percentages
Really Excellent	4	40
Satisfactory,	4	40
Typical,	2	20
Poor	0	0
Really Awful	0	0
	10	100

Source: Author (2023)

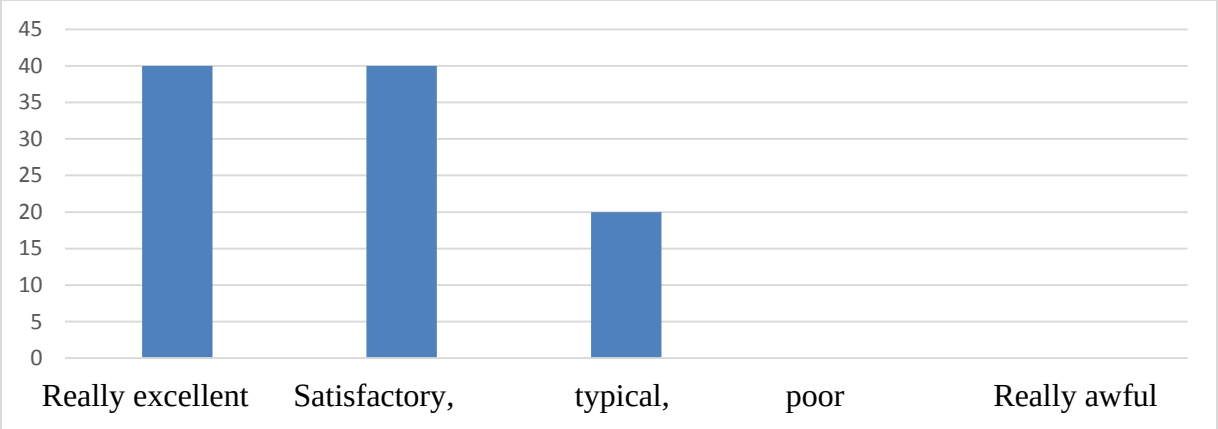


Figure 4.2.24 Science Curriculum in the School

Source: Author (2023)

The Table 4.2.24 and Figure 4.2.24 presents the responses of teachers regarding their evaluation of the science curriculum at their school. The responses are categorized into different levels: "Really Excellent," "Satisfactory," "Typical," "Poor," and "Really Awful." According to the table, there were a total of 10 teachers who provided their feedback on the science curriculum. Out of these, 4 teachers, or 40% of the total, rated the curriculum as "Really Excellent." This suggests that these teachers believe the curriculum is of exceptionally high quality and meets or exceeds their expectations. Another 4 teachers, also accounting for 40% of the total, considered the curriculum as "Satisfactory." This indicates that these teachers found the curriculum to be acceptable and meeting the minimum requirements, but not necessarily outstanding. Two teachers, representing 20% of the total, characterized the curriculum as "Typical." This implies that they perceive the curriculum as average or standard, without any significant strengths or weaknesses. Importantly, no teachers rated the curriculum as "Poor" or "Really Awful." This suggests that none of the respondents considered the curriculum to be below expectations or of extremely low quality.

4.2.25 Frequency of giving chemistry exams

The researcher analyzed the following based on teacher's frequency of giving chemistry quizzes or examinations that are term-based

Table 4.2.25 Frequency of giving chemistry exams

No. of Students	Frequency	Percentages
Always use moderation	5	50
hardly	2	20
never at all	3	30
	10	100

Source: Author (2023)

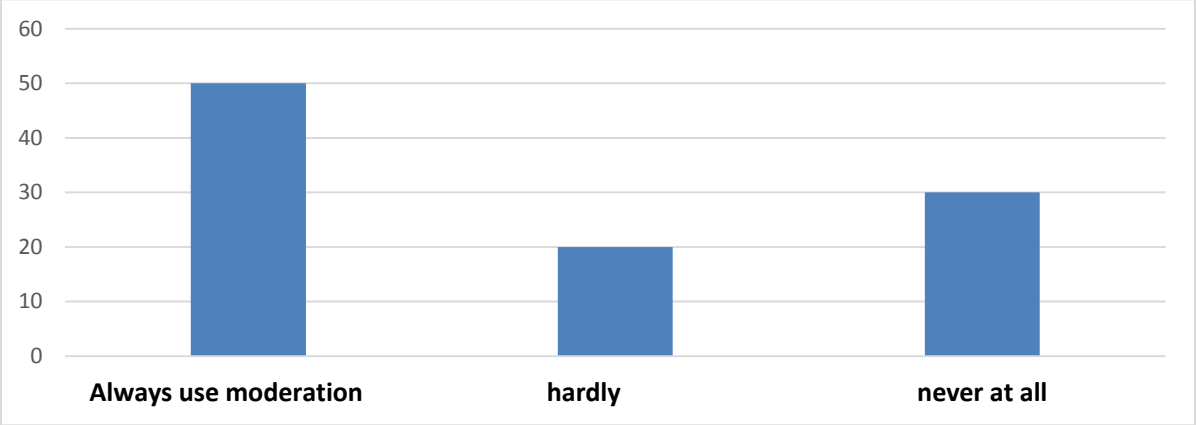


Figure 4.2.25 Frequency of giving chemistry exams

Source: Author (2023)

Table 4.2.25 Figure 4.2.25 suggests that a majority of the students (50%) consistently take chemistry quizzes or examinations with moderation. However, a significant portion of the students (50%) either take these assessments infrequently (20%) or not at all (30%). This distribution of responses implies a varied level of commitment and engagement among the students in terms of their chemistry studies

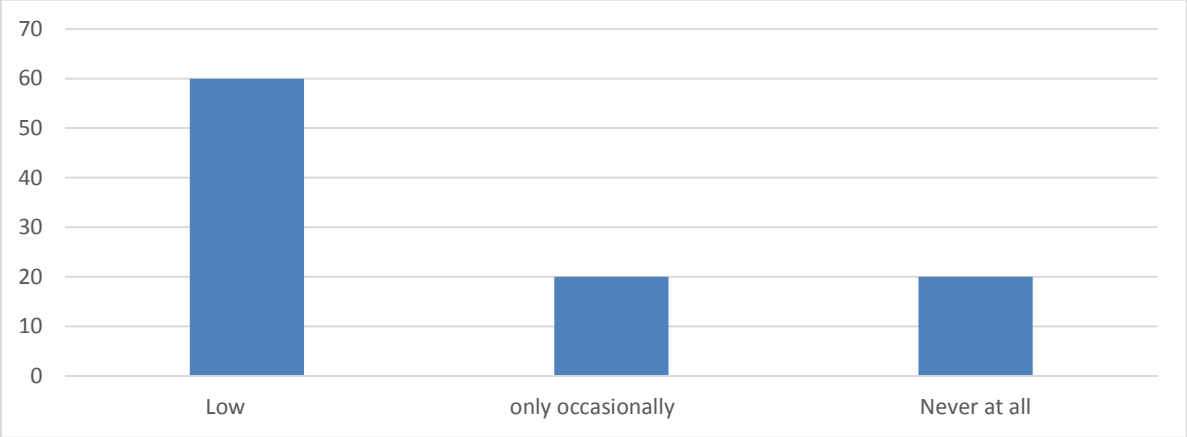
4.2.26 Comprehension of the Exam Questions

Table 4.2.26 Comprehension of the Exam Questions

Questions to Comprehend	Frequency	Percentages
Low	6	60
only occasionally	2	20
Never at all	2	20
	10	100

Source: Author (2023)

Table 4.2.26 Comprehension of the Exam Questions



Source: Author (2023)

Table 4.2.26 and figure 4.2.26 represent the responses or behaviors of teachers in regards to going over questions to comprehend. The table consists of three categories indicating the frequency with which teachers go over questions to comprehend: "Low," "only occasionally," and "Never at all." 60% of the teachers reported a low frequency of going over questions to comprehend. This suggests that they might not spend a significant amount of time or effort in reviewing and understanding the questions. 20% of the teachers stated that they only occasionally go over questions to comprehend. This implies that they may engage in reviewing questions sporadically, but not consistently or extensively. Another 20% of the teachers reported never going over questions to comprehend. This indicates that they do not make an effort to review or understand the questions before proceeding. It is important to note that the

percentages add up to 100%, indicating that all the teachers surveyed fell into one of these three categories.

4.2.27 Teachers of chemistry assisting to pass exams

Table 4.2.27 Teachers of chemistry assisting to pass exams

Questions to Comprehend	Frequency	Percentages
Firmly Concur	92	64
Concur	22	15
Disapprove	14	10
Not At All Agreeable	12	8
Absolutely Disapprove.	4	3
	144	100

Source: Author (2023)

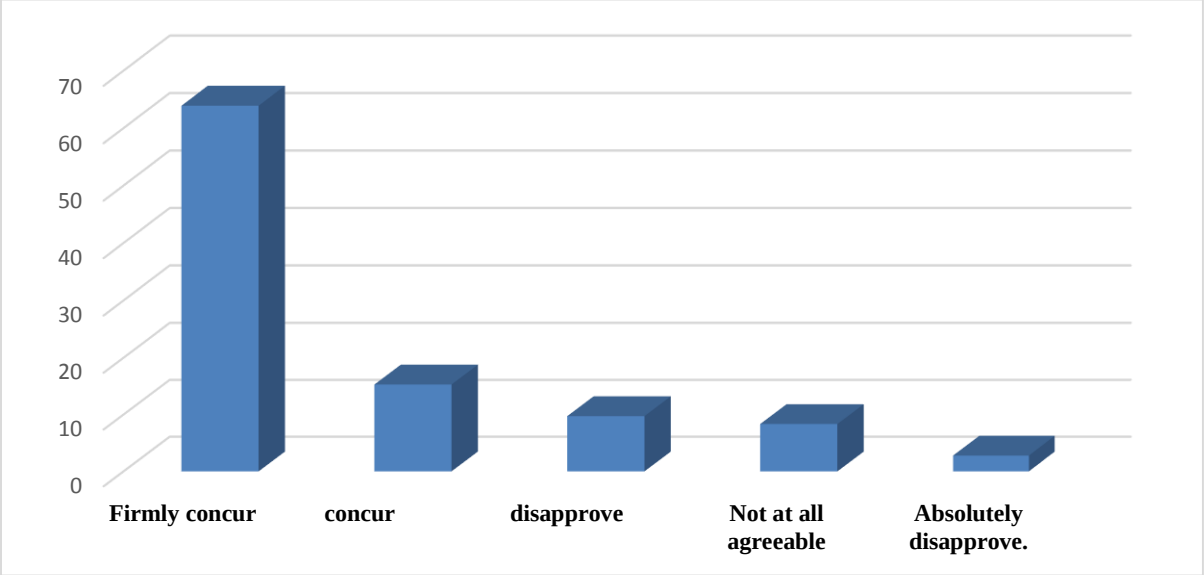


Figure 4.2.27 Teachers of chemistry assisting to pass exams

Source: Author (2023)

Table 4.2.27 and Figure 4.2.27 presents the results of a survey regarding teachers of chemistry' assistance in helping students pass chemistry exams. The survey asked students to respond to a set of questions related to their agreement or disagreement with the effectiveness of teacher assistance. The table provides the frequency and percentages of responses for each category. The first column, "Questions to Comprehend," represents the specific statements or questions that the students were asked to respond to. The following are the response categories and their

corresponding frequencies and percentages: Firmly Concur: 92 students (64%) responded with a strong agreement, indicating that they strongly believe that teachers of chemistry are helpful in assisting them to pass exams. Concur: 22 students (15%) responded with agreement, indicating that they believe teachers of chemistry are helpful, but not as strongly as those in the "Firmly Concur" category. Disapprove: 14 students (10%) responded with disagreement, suggesting that they do not believe teachers of chemistry are effective in helping them pass exams. Not At All Agreeable: 12 students (8%) responded with strong disagreement, indicating that they strongly believe that teachers of chemistry are not helpful in assisting them to pass exams. Absolutely Disapprove: 4 students (3%) responded with an absolute disagreement, indicating that they strongly believe that teachers of chemistry are not at all helpful in assisting them to pass exams. Overall, there were 144 students who participated in the survey, accounting for 100% of the total responses.

Based on this data, it can be concluded that the majority of students (64%) firmly believe that teachers of chemistry are helpful in assisting them to pass exams. However, a small portion of students (8%) strongly disagree with this idea, and a further 3% hold an absolute disapproval of teacher assistance in passing chemistry exams.

4.2.28 Sufficiency of tools for chemical reactions

Table 4.2.28 Sufficiency of tools for chemical reactions

Questions to Comprehend	Frequency	Percentages
firmly concur	70	61
Agree	20	18
Disagree	10	9
firmly disagree	10	9
unsure	4	4
	114	100

Source: Author (2023)

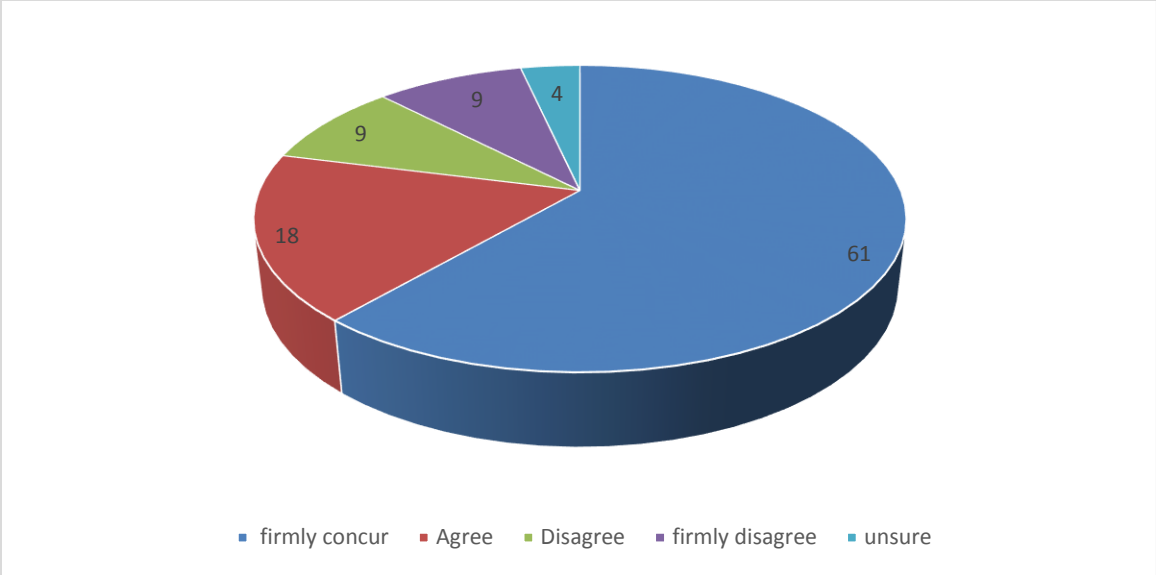


Figure 4.2.28 Chemical Reactions Tools

Source: Author (2023)

Table 4.2.28 and Figure 4.2.28 presents the results of a survey regarding students' perception of the sufficiency of tools for chemical reactions. The survey asked students to respond to a set of questions related to their agreement or disagreement with the statement regarding the adequacy of tools for chemical reactions. The table provides the frequency and percentages of responses for each category. The first column, "Questions to Comprehend," represents the specific statement or question that the students were asked to respond to. The following are the response categories and their corresponding frequencies and percentages: Firmly Concur: 70 students (61%) responded with a strong agreement, indicating that they firmly believe that the tools available for chemical reactions are sufficient. Agree: 20 students (18%) responded with agreement, suggesting that they believe the tools for chemical reactions are sufficient, but not as strongly as those in the "Firmly Concur" category. Disagree: 10 students (9%) responded with disagreement, indicating that they do not believe the tools for chemical reactions are sufficient. Firmly Disagree: 10 students (9%) responded with a strong disagreement, suggesting that they strongly believe the tools for chemical reactions are not sufficient. Unsure: 4 students (4%) responded with uncertainty, indicating that they are unsure about the sufficiency of tools for chemical reactions.

Based on this data, it can be concluded that a majority of students (61%) firmly believe that the tools available for chemical reactions are sufficient. However, a notable portion of students

(18%) agree with this statement but not as strongly. There is a smaller group of students (9%) who disagree or firmly disagree with the sufficiency of tools for chemical reactions. Additionally, a small percentage (4%) of students are unsure about this matter.

4.2.29 Chemistry Resources

Table 4.2.29 Chemistry Resources

Statement	firmly concur	Agree	unsure	Disagree	firmly disagree	Total
There is a processing facility and enough working computers at my training establishment.	24	55	21	10	4	114
Chemistry can be taught by the teacher(s) or using a machine lacking any issues.	20	10	54	16	14	114
You'll find sufficient Disks and digital texts for teaching chemical online.	30	54	16	10	4	114
Any kind of science in my institution have sufficient resources.	21	56	11	8	18	114
Students have access to enough previous essays and textbooks for science preparation.	20	10	54	16	14	114
It has sufficient labs to learn science.	13	44	23	10	24	114
For all science tasks, you'll require sufficient materials and supplies.	24	56	11	14	9	114
Our educational institution employs a scientist for the chemical department.	24	55	21	10	4	114

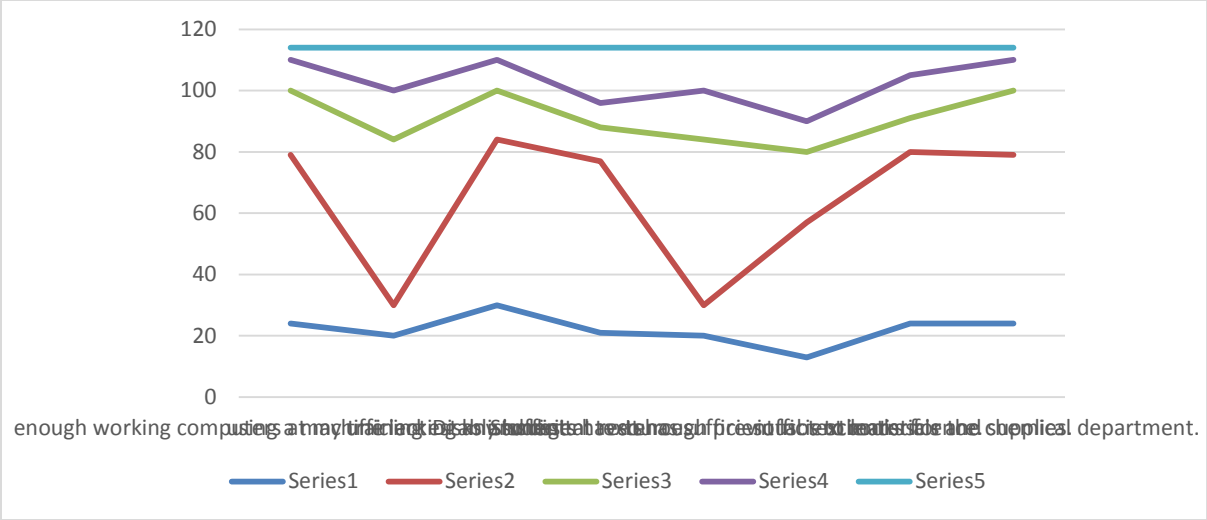


Figure 4.2.29 Chemistry Resources

Source: Author (2023)

Table 4.2.29 and Figure 4.2.29 provides responses from students regarding the availability of chemistry review resources at their school. The responses are categorized into five levels of agreement: "firmly concur," "Agree," "unsure," "Disagree," and "firmly disagree. “There is a processing facility and enough working computers at my training establishment." 24 students firmly concur, 55 students agree, 21 students are unsure, 10 students disagree and 4 students firmly disagree. The majority of students (firmly concur + agree) indicate that there is a processing facility and enough working computers at their training establishment. However, a significant number of students are unsure or disagree, suggesting that there may be some concerns or limitations with the availability of computers and processing facilities.

That "Chemistry can be taught by the teacher(s) or using a machine lacking any issues."20 students firmly concur10 students agree54 students are unsure16 students disagree 14 students firmly disagree. The responses are quite divided for this statement, with a significant number of students being unsure. This suggests that there may be varying opinions among students regarding whether chemistry can be effectively taught using machines without any issues. That "You'll find sufficient disks and digital texts for teaching chemical online." 30 students firmly concur, 54 students agree, 16 students are unsure, 10 students disagree and 4 students firmly disagree. The majority of students (firmly concur + agree) believe that there are sufficient disks and digital texts for teaching chemistry online. However, a notable number of students are unsure or disagree, indicating that there may be some doubts or limitations regarding the

availability of these resources. That "Any kind of science in my institution has sufficient resources."21 students firmly concur, 56 students agree, 11 students are unsure, 8 students disagree 18 students firmly disagree. The majority of students (firmly concur + agree) believe that their institution has sufficient resources for any kind of science. However, there is a considerable number of students who are unsure or firmly disagree, suggesting that there may be concerns or inadequacies regarding resource availability for science subjects. That "Students have access to enough previous essays and textbooks for science preparation." 20 students firmly concur, 10 students agree, 54 students are unsure, 16 students disagree and 14 students firmly disagree. The responses are quite divided for this statement, similar to statement 2. A significant number of students are unsure, indicating that there may be mixed opinions among students regarding the availability of previous essays and textbooks for science preparation. That "It has sufficient labs to learn science.",13 students firmly concur, 44 students agree, 23 students are unsure, 10 students disagree, 24 students firmly disagree, The responses for this statement are more mixed compared to the previous statements. While a majority of students (firmly concur + agree) believe that there are sufficient labs to learn science, there is a notable number of students who are unsure or disagree, suggesting potential limitations in the availability of lab facilities. That "For all science tasks, you'll require sufficient materials and supplies." 24 students firmly concur, 56 students agree, 11 students are unsure, 14 students disagree and 9 students firmly disagree. That educational institution employs a scientist for the chemical department" is as follows: 24 students firmly concur, 55 students agree, 21 students are unsure, 10 students disagree and 4 students firmly disagree. A total of 114 students responded to this statement.

4.2.30 Utilization of information and communication technologies

The respondents were asked to respond to statement on whether utilization of information and communication technologies affect performance in chemistry subjects. Likert scale was (1 firmly concur, 2 Agree, 3 unsure 4 Disagree 5firmly disagree). The findings were as follows:

Table 4.2.30 Utilization of information and communication technologies

Statement	1	2	3	4	5	Total
Computing facilities are occasionally used by science teachers to instruct the subject.	34	28	2	44	6	114
Tech is occasionally made available to students so they can study chemical reactions using Discs and computerized resources.	13	44	23	10	24	114
Students apply texts and study guides to adequately prepare to take science examinations.	62	40	8	3	1	114
Students fare best in chemistry examinations when they use electronic resources like Disks or different tools.	21	56	11	8	18	114
Science laboratory work is very important for students to succeed in chemical exams.	24	55	21	10	4	114
Scientists contribute significantly to how well students do on science exams.	14	35	21	16	28	114

Source: Author (2023)

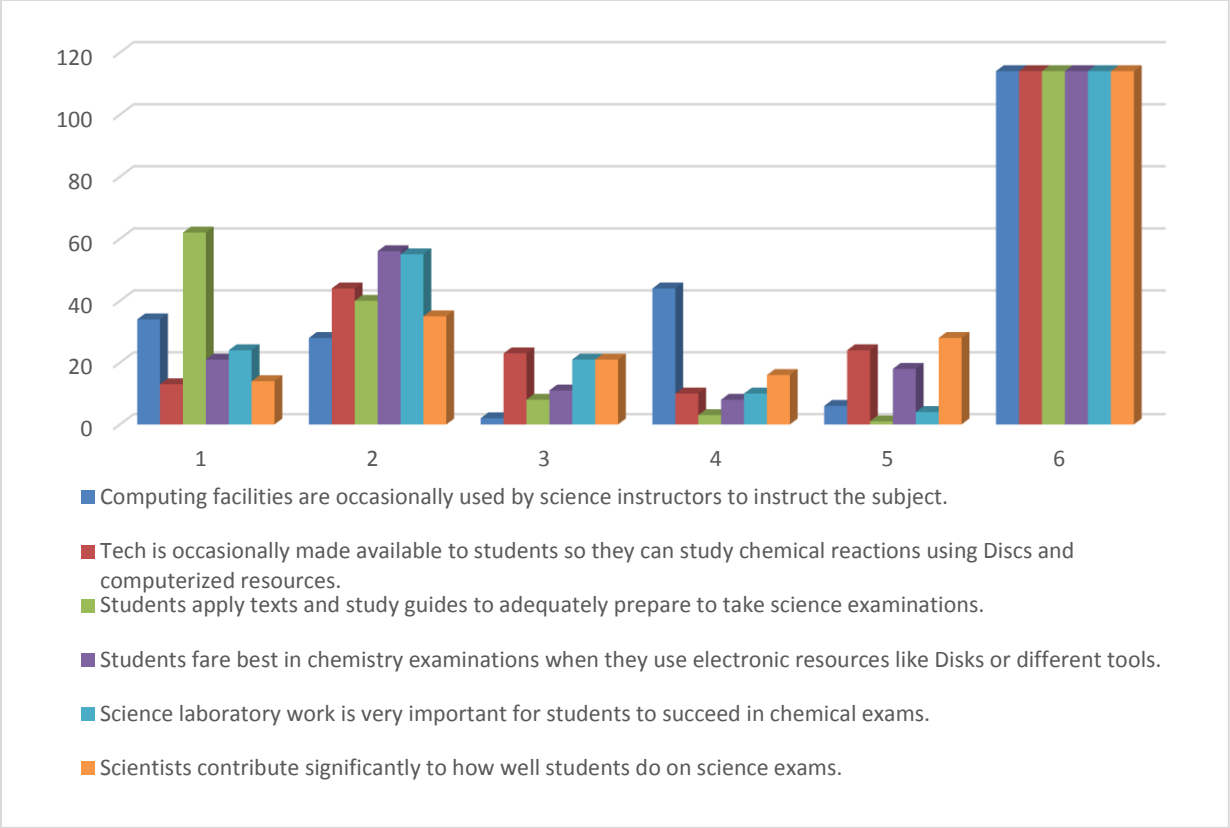


Figure 4.2.30 Utilization of information and communication technologies

Source: Author (2023)

The Table 4.2.30 and Figure 4.2.30 provides responses related to the utilization of information and communication technologies (ICT) and teaching and learning tools. The responses are categorized into five levels of agreement: "firmly concur," "Agree," "unsure," "Disagree," and "firmly disagree." Here is the interpretation for each statement: “Computing facilities are occasionally used by science teachers to instruct the subject."34 students firmly concur, 28 students agree, 2 students are unsure, 44 students disagree 6 students firmly disagree. A majority of students disagree (disagree + firmly disagree) with the statement, indicating that computing facilities are not regularly used by science teachers to instruct the subject. This suggests that there may be limited utilization of computing facilities for teaching in the context of science subjects. While that "Tech is occasionally made available to students so they can study chemical reactions using discs and computerized resources."13 students firmly concur, 44 students agree, 23 students are unsure, 10 students disagree and 24 students firmly disagree. The responses are quite divided for this statement. While a significant number of students agree that technology is occasionally made available for studying chemical reactions, there is also a

considerable number of students who are unsure or disagree. This indicates some uncertainty or variation in the availability and utilization of technology for studying chemistry. And that "Students apply texts and study guides to adequately prepare to take science examinations." 62 students firmly concur, 40 students agree, 8 students are unsure, 3 students disagree and 1 student firmly disagrees. The majority of students (firmly concur + agree) believe that using texts and study guides adequately prepares them for science examinations. This indicates a strong consensus among students regarding the effectiveness of traditional learning resources like texts and study guides. That "Students fare best in chemistry examinations when they use electronic resources like discs or different tools." 21 students firmly concur, 56 students agree, 11 students are unsure, 8 students disagree and 18 students firmly disagree. The majority of students (firmly concur + agree) believe that using electronic resources like discs or different tools leads to better performance in chemistry examinations. However, there are a notable number of students who are unsure or disagree, suggesting some uncertainty or disagreement regarding the effectiveness of electronic resources for studying chemistry.

While "Science laboratory work is very important for students to succeed in chemical exams."24 students firmly concur, 55 students agree, 21 students are unsure, 10 students disagree, 4 students firmly disagree. The majority of students (firmly concur + agree) believe that science laboratory work is crucial for success in chemical exams. This indicates a consensus among students regarding the importance of practical laboratory work in the field of chemistry. And that "Scientists contribute significantly to how well students do on science exams."14 students firmly concur, 35 students agree, 21 students are unsure, 16 students disagree and 28 students firmly disagree. The responses for this statement are quite varied. While a significant number of students agree or firmly concur that scientists contribute significantly to students' performance in science exams, there is also a substantial number of students who are unsure or disagree. This indicates a lack of consensus among students regarding the impact of scientists on exam performance.

4.2.31 ICT materials and chemistry Performance

The respondents were asked to respond to the statement on whether Chemistry ICT materials affect performance in the chemistry subject. Likert scale was (1 firmly concur, 2 Agree, 3 unsure 4 Disagree 5firmly disagree). The findings were as follows:

Table 4.2.31 Chemistry Performance

Statement	firmly concur	Agree	Indifferent	Disagree	firmly disagree	Total
utilization of a variety of ICT materials, learning resources, and teaching aids	21	56	11	8	18	114
possession of a variety of ICT materials, learning resources, and teaching aids	20	10	54	16	14	114
Teachers of chemistry take part in ICT seminars and classes when asked.	13	44	23	10	24	114
Chemistry textbooks and educational CDs are widely available for teachers.	11	66	11	8	18	114
There are enough chemistry texts available for all types of students.	24	55	21	10	4	114
For chemical review, students have access to plenty of old papers and texts.	20	57	11	8	18	114
Chemical labs are accessible for all classes.	14	65	21	10	4	114
There are enough substances and tools to finish the chemistry practicals.	28	10	50	21	5	114
The number of classrooms and libraries needed for teaching and exam preparation is adequate.	14	35	21	16	28	114
There are adequate illustrations and models to teach chemistry.	13	44	23	10	24	114

Source: Author (2023)

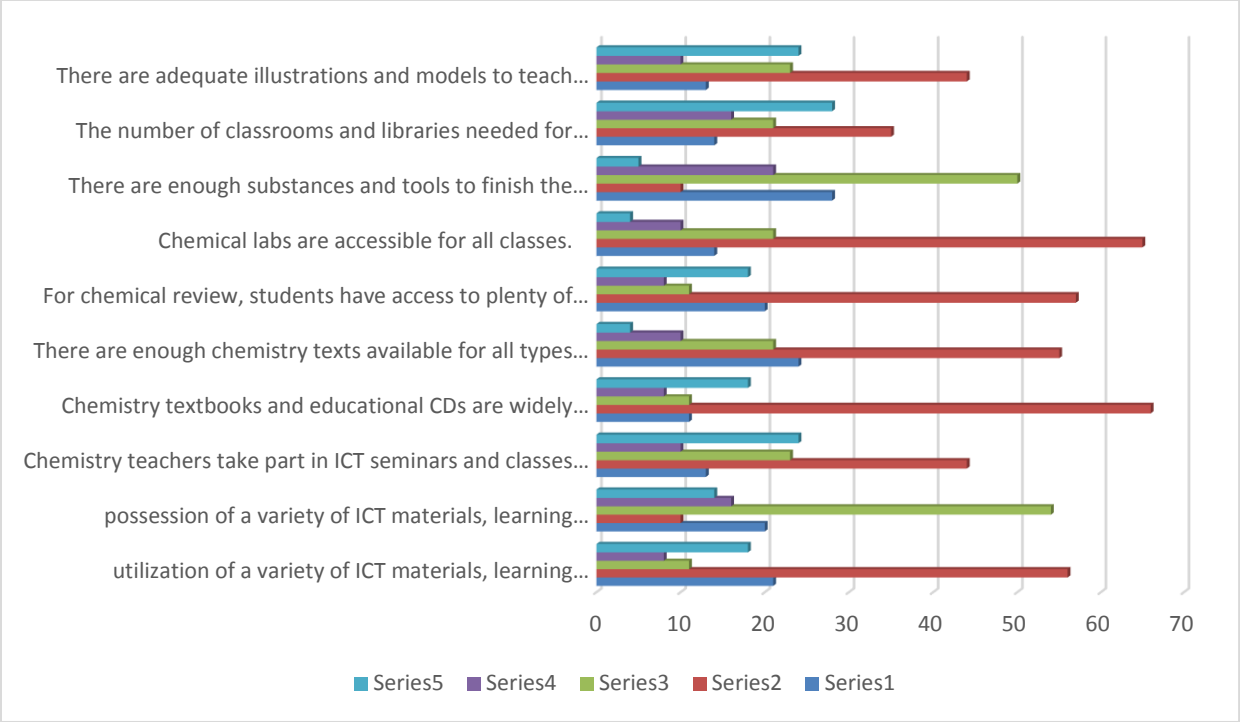


Figure 4.2.31 Chemistry Performance

Source: Author (2023)

Table 4.2.31 and Figure 4.2.31 provides data on various statements related to chemistry performance in school and the responses from participants, categorized into five levels of agreement: "firmly concur," "agree," "indifferent," "disagree," and "firmly disagree." The total number of respondents for each statement is 114.On utilization of a variety of ICT materials, learning resources, and teaching aids: "Firmly concur": 21 "Agree": 56 "Indifferent": 11 "Disagree": 8 and "Firmly disagree": 18 This suggests that a majority of respondents (77 out of 114) either firmly concur or agree with the statement, indicating that there is a positive perception of utilizing various ICT materials, learning resources, and teaching aids in the While on possession of a variety of ICT materials, learning resources, and teaching aids: "Firmly concur": 20 "Agree": 10 "Indifferent": 54"Disagree": 16"Firmly disagree": 14. The responses indicate that a significant number of respondents (54 out of 114) are indifferent towards the possession of various ICT materials, learning resources, and teaching aids in chemistry education. However, there is a relatively low level of agreement and firm agreement, suggesting that there might be a lack of perceived possession of such resources. While that

Teachers of chemistry take part in ICT seminars and classes when asked: "Firmly concur": 13 "Agree": 44 "Indifferent": 23 "Disagree": 10 and "Firmly disagree": 24. The responses indicate that a majority of respondents (57 out of 114) either firmly concur or agree that teachers of chemistry participate in ICT seminars and classes when asked. This suggests a positive perception of teacher engagement with ICT in the context of chemistry education.

On that Chemistry textbooks and educational CDs are widely available for teachers: "Firmly concur": 11 "Agree": 66 "Indifferent": 11 "Disagree": 8 and "Firmly disagree": 18. The data shows that a significant number of respondents (77 out of 114) agree or firmly agree that chemistry textbooks and educational CDs are widely available for teachers, indicating a positive perception of the availability of these resources. On that there are enough chemistry texts available for all types of students: "Firmly concur": 24 "Agree": 55 "Indifferent": 21 "Disagree": 10 "Firmly disagree": 4. The responses suggest that a majority of respondents (79 out of 114) either firmly concur or agree that there are enough chemistry texts available for all types of students, indicating a positive perception of the availability of textbooks. That for chemical review, students have access to plenty of old papers and texts: "Firmly concur": 20 "Agree": 57 "Indifferent": 11"Disagree": 8 and "Firmly disagree": 18. The data indicates that a majority of respondents (77 out of 114) either firmly concur or agree that students have access to plenty of old papers and texts for chemical review, suggesting a positive perception of the availability of these resources. There are enough substances and tools to finish the chemistry practical's: "Firmly concur": 28 "Agree": 10 "Indifferent": 50 "Disagree": 21 "Firmly disagree": 5 the responses indicate that a significant number of respondents (38 out of 114) either firmly concur or agree that there are enough substances and tools to finish the chemistry practicals. However, a considerable number of respondents (26 out of 114) either disagree or firmly disagree, suggesting a perceived insufficiency of resources for practical work. The number of classrooms and libraries needed for teaching and exam preparation is adequate: "Firmly concur": 14 "Agree": 35 "Indifferent": 21 "Disagree": 16 "Firmly disagree": 28 the responses show mixed opinions regarding the adequacy of classrooms and libraries for teaching and exam preparation. While a significant number of respondents (49 out of 114) either firmly concur or agree, there is also a considerable number (44 out of 114) who either disagree or firmly disagree, indicating varying perceptions regarding the sufficiency of these facilities. There are adequate illustrations and models to teach chemistry: "Firmly concur": 13

"Agree": 44 "Indifferent": 23 "Disagree": 10 "Firmly disagree": 24 The responses suggest that a majority of respondents (57 out of 114) either firmly concur or agree that there are adequate illustrations and models to teach chemistry. However, a significant number of respondents (34 out of 114) either disagree or firmly disagree, indicating some dissatisfaction or perceived inadequacy in this aspect.

4.2.32 Use of ICT materials and methods for education and learning

The respondents were asked to respond to statement on utilization of ICT materials and methods for education and learning. Likert scale was (1 firmly concur, 2 Agree, 3 unsure 4 Disagree 5firmly disagree). The findings were as follows:

Table 4.2.32 Use of ICT materials and methods for education and learning

the use of ICT materials and methods for education and learning	firmly concur	Agree	Indifferent	Disagree	firmly disagree	Total
Competent teachers of chemistry can teach chemistry using technology.	16	61	11	8	18	114
. Teachers of chemistry use ICT to instruct the topic by utilizing CDs and laptops	11	66	11	8	18	114
To properly prepare for chemistry exams, students use texts and study materials.	24	55	21	10	4	114
Chemistry practicals are frequently carried out in order to improve understanding.	20	57	11	8	18	114
Teachers of chemistry use models and figures frequently during instruction to help students understand what they are experiencing.	24	55	21	10	4	114
In order to enhance their trust before chemistry exams, students make effective use of the classroom and library for review.	20	10	54	16	14	114

Source: Author (2023)

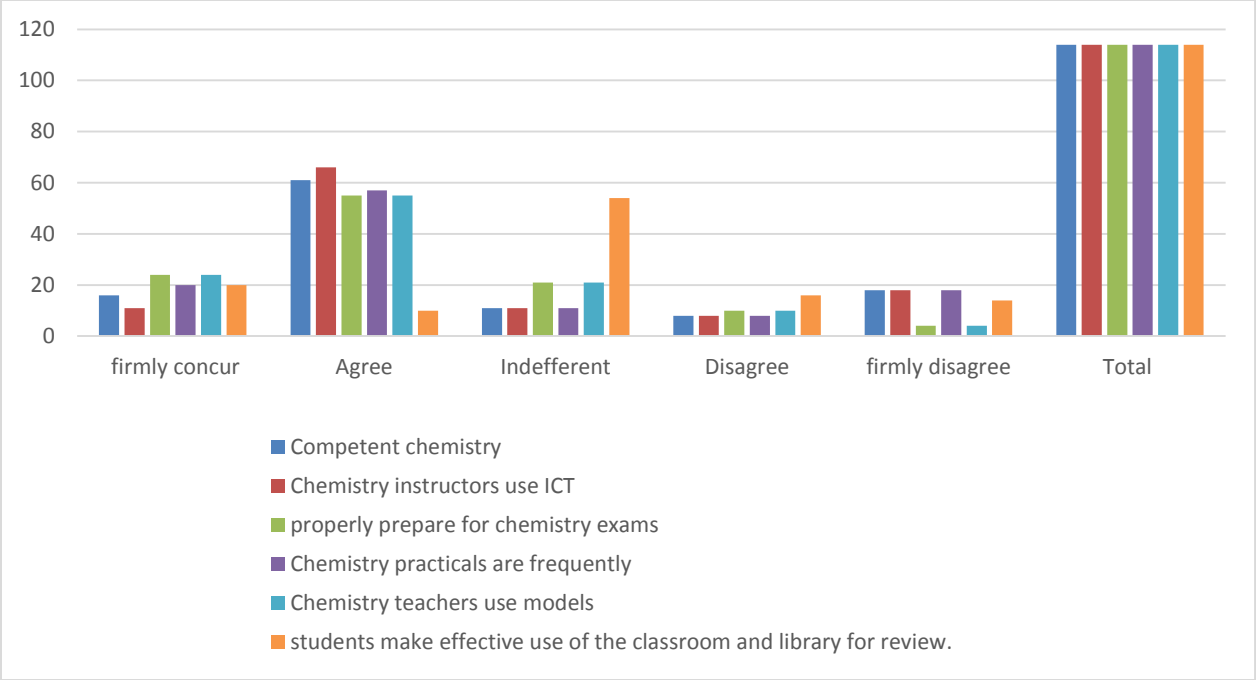


Figure 4.2.32 Use of ICT materials and methods for education and learning

Source: Author (2023)

The Table 4.2.32 and Figure 4.2.32 provides data on the use of ICT materials and methods for education and learning in school, specifically in the context of chemistry. The responses from participants are categorized into five levels of agreement: "firmly concur," "agree," "indifferent," "disagree," and "firmly disagree." The total number of respondents for each statement is 114. Competent teachers of chemistry can teach chemistry using technology: “Firmly concur": 16"Agree": 61 "Indifferent": 11 "Disagree": 8 and "Firmly disagree": 18. The responses suggest that a majority of respondents (77 out of 114) either firmly concur or agree that competent teachers of chemistry can effectively teach chemistry using technology. However, there is a notable number of respondents (26 out of 114) who either disagree or firmly disagree with this statement.

Teachers of chemistry use ICT to instruct the topic by utilizing CDs and laptops: "Firmly concur": 11"Agree": 66"Indifferent": 11"Disagree": 8"Firmly disagree": 18. The data indicates that a significant majority of respondents (77 out of 114) either firmly concur or agree that teachers of chemistry use ICT, particularly CDs and laptops, to instruct the topic. This suggests a positive perception of using ICT tools for instructional purposes in chemistry education. To properly prepare for chemistry exams, students use texts and study materials: "Firmly concur":

24 "Agree": 55 "Indifferent": 21 "Disagree": 10 and "Firmly disagree": 4. The responses suggest that a majority of respondents (79 out of 114) either firmly concur or agree that students use texts and study materials to adequately prepare for chemistry exams. This indicates the perceived importance of traditional learning resources in exam preparation.

Chemistry practicals are frequently carried out to improve understanding: "Firmly concur": 20 "Agree": 57 "Indifferent": 11 "Disagree": 8 "Firmly disagree": 18. The data suggests that a majority of respondents (77 out of 114) either firmly concur or agree that chemistry practical's are frequently conducted to enhance understanding. This indicates a positive perception of the importance of hands-on practical work in chemistry education. Teachers of chemistry use models and figures frequently during instruction to help students understand: "Firmly concur": 24 "Agree": 55 "Indifferent": 21 "Disagree": 10 and "Firmly disagree": 4. The responses suggest that a majority of respondents (79 out of 114) either firmly concur or agree that teachers of chemistry frequently use models and figures during instruction to aid student understanding. This highlights the perceived effectiveness of visual aids in teaching chemistry.

4.2.33 ICT Instruction and Skills Required

Table 4.2.33 ICT Instruction and Skills Required

Instruction and Skills Required	Frequency	Percentages
YES	84	74
No	30	26
	114	**100**

Source: Author (2023)

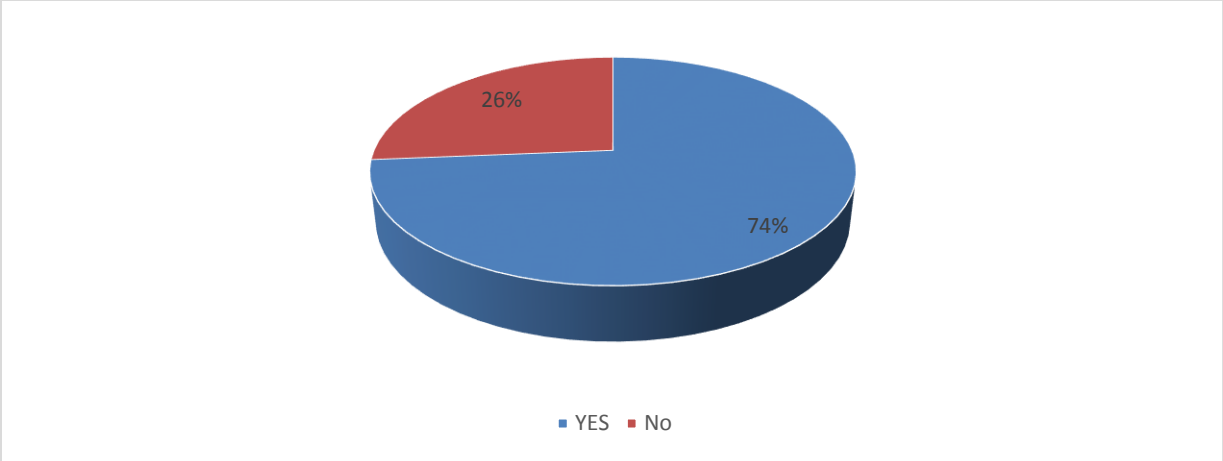


Figure 4.2.33 ICT instruction and skills required for chemistry performance

Source: Author (2023)

The Table 4.2.33 and Figure 4.2.33 provides data on student responses regarding the acquisition of instruction and skills required to use ICT successfully during the teaching and learning of chemistry through seminars. The data is presented in frequencies and percentages. Out of the 114 respondents: 84 students (74%) responded "YES" to having acquired the necessary instruction and skills. 30 students (26%) responded "No" to not having acquired the necessary instruction and skills. This data suggests that a significant majority of students (74%) feel that they have acquired the instruction and skills required to use ICT successfully in the context of learning and teaching chemistry through seminars. On the other hand, a notable portion of students (26%) responded negatively, indicating that they have not acquired the necessary instruction and skills. Overall, the data highlights the varying levels of preparedness and proficiency among students when it comes to utilizing ICT effectively in chemistry education, with a majority feeling adequately equipped and a minority feeling they still need further instruction and skills development.

4.2.34 Use of ICT to Teach and Study Chemistry

Table 4.2.34 use of ICT to teach and study chemistry

Instruction and Skills Required	Frequency	Percentages
Always	6	60
moderate	3	30
rarely	1	10
never	0	0
	10	100

Source: Author (2023

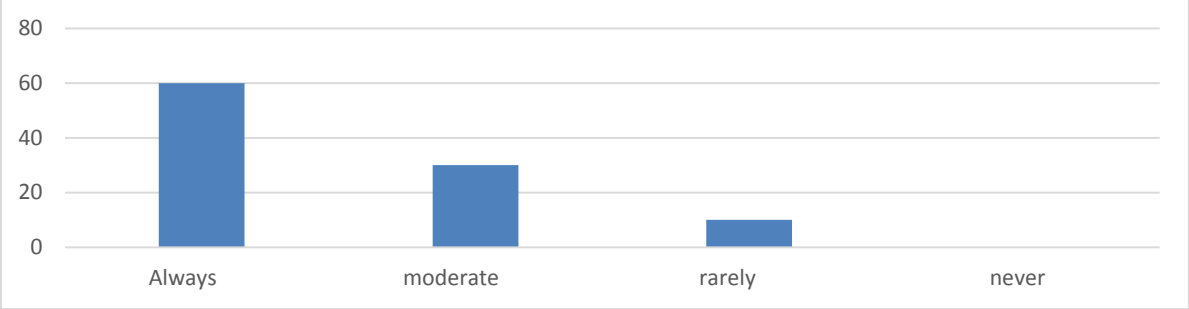


Figure 4.2.34 use of ICT to teach and study chemistry

Source: Author (2023)

Based on the given data in Table 4.2.34 and Figure 4.2.34 it represents the frequencies and percentages of different levels of ICT (Information and Communication Technology) usage by teachers in teaching chemistry. The table shows the distribution of responses regarding the frequency of ICT usage and the corresponding percentages for each category. The table includes four categories: Always: This category indicates that 6 out of 10 respondents use ICT consistently in their teaching and studying of chemistry. This signifies a high level of ICT integration, suggesting that these teachers heavily rely on ICT tools and resources in their instructional practices. Moderate: This category represents 3 out of 10 respondents who use ICT to a moderate extent. These teachers incorporate ICT into their chemistry teaching and studying activities but may not rely on it as extensively as those in the "Always" category. They might use ICT selectively or for specific purposes within their instructional approach. Rarely: This category accounts for 1 out of 10 respondents who use ICT rarely in their teaching and studying of chemistry. These teachers have minimal or sporadic use of ICT tools and

resources. Their reliance on ICT may be infrequent, possibly due to limited access, resources, or personal preference. Never: This category indicates that none of the respondents reported never using ICT for teaching and studying chemistry. It implies that all surveyed teachers have some level of engagement with ICT in their chemistry education practices.

Overall, the data suggests a positive trend in the utilization of ICT for teaching and studying chemistry among the surveyed teachers, with a majority falling into the "Always" category. This highlights the importance and increasing adoption of ICT in enhancing chemistry education, potentially leading to more interactive and engaging learning experiences for students.

4.2.35 Students' success on chemistry examinations

Table 4.2.35 Students' success on chemistry examinations

Students' Success on Chemistry Examinations	Frequency	Percentages
Strongly agree	5	50
Agree	2	20
Disagree	0	0
strongly disagree	3	30
Not sure	0	0
	10	100

Source: Author (2023)

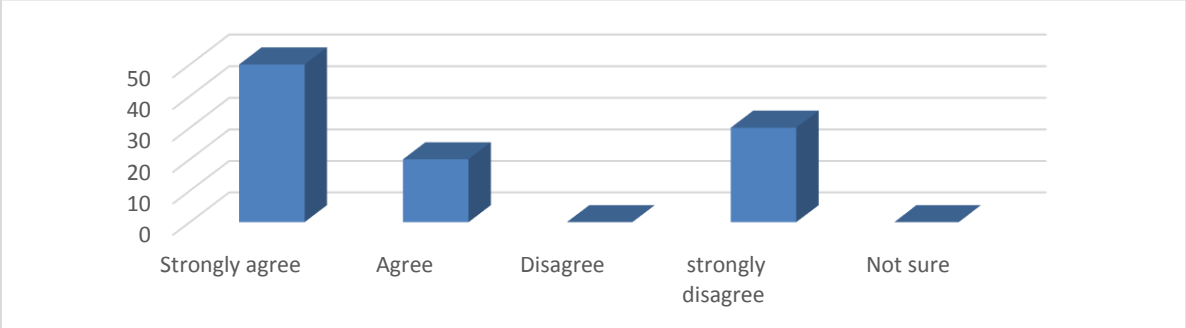


Figure: 4.2.35 Students' Success on Chemistry Examinations

Source: Author (2023)

Table 4.2.35 and Figure: 4.2.35 represents the frequencies and percentages of responses from teachers regarding the impact of using ICT in chemistry teaching and learning on students' success on chemistry examinations. The table shows the distribution of responses indicating the level of agreement or disagreement with the statement. Strongly agree: This category indicates that 5 out of 10 respondents strongly agree that the use of ICT in chemistry teaching and learning has a positive impact on students' success on chemistry examinations. These teachers firmly believe that integrating ICT tools and resources enhances students' understanding, engagement, and overall performance in chemistry examinations. Agree: This category represents 2 out of 10 respondents who agree that using ICT in chemistry teaching and learning positively impacts students' success on chemistry examinations. These teachers acknowledge the potential benefits of ICT in facilitating students' learning and achievement in chemistry exams, but their level of agreement may be slightly lower than those in the "Strongly agree" category. Disagree: This category indicates that none of the respondents disagree with the statement that the use of ICT in chemistry teaching and learning impacts students' success on chemistry examinations. This suggests that all surveyed teachers either agree or strongly agree with the statement. Strongly disagree: This category represents 3 out of 10 respondents who strongly disagree that using ICT in chemistry teaching and learning has an impact on students' success on chemistry examinations. These teachers hold the belief that ICT usage does not significantly influence students' performance in chemistry exams and may prefer more traditional teaching methods or approaches. Not sure: This category indicates that none of the respondents were unsure about the impact of using ICT in chemistry teaching and learning on students' success on chemistry examinations. It implies that all surveyed teachers have a definite opinion, either agreeing, strongly agreeing, or strongly disagreeing with the statement.

4.2.36 Study Tools By Students

Table 4.2.36 Study Tools by Students

Statement		T	F
chemistry textbooks and study tools by students has a major impact on their performance on chemistry	Frequency	8	2
	Percentage	80%	20%
Lack of access to a lab, chemicals, and tools when taking practical examinations has no impact on students' success on chemistry exams	Frequency	7	3
	Percentage	70%	30%
the lab technician has a significant impact on students' success on the chemistry exam	Frequency	6	4
	Percentage	60%	40%
A laboratory technician needs to have the necessary training and skills to influence students' success on chemistry examinations	Frequency	6	4
	Percentage	60%	40%

Source: Author (2023)

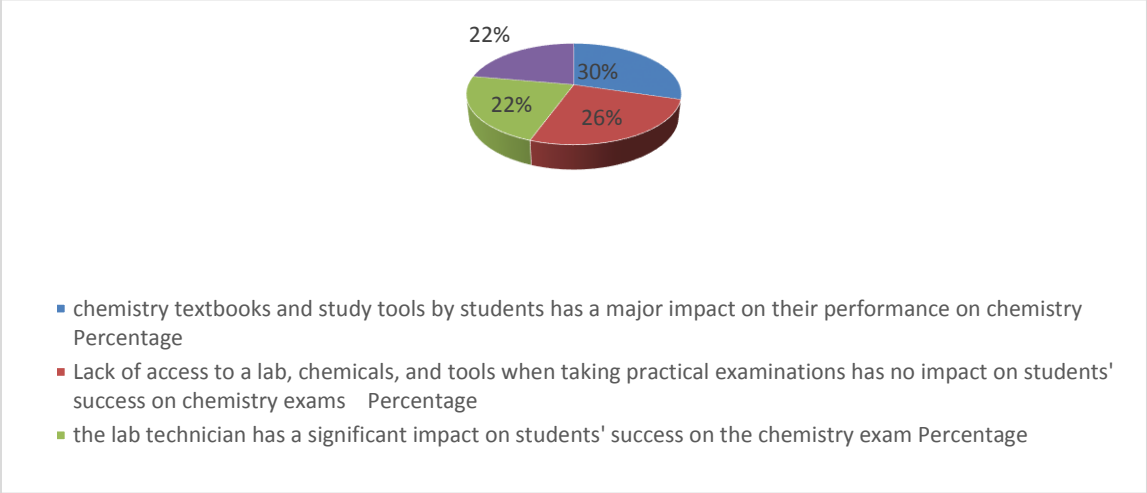


Figure Table 4.2.36 Study Tools by Students

Source: Author (2023)

Table 4.2.36 and Figure Table 4.2.36 presents the frequencies and percentages of responses from teachers regarding their agreement or disagreement with various statements related to factors impacting students' performance on chemistry exams. 80% of the respondents agree with the statement that chemistry textbooks and study tools used by students have a major

impact on their performance in chemistry. This suggests that the majority of teachers recognize the significance of textbooks and study tools in shaping students' understanding and success in the subject. 70% of the respondents agree with the statement that a lack of access to a lab, chemicals, and tools during practical examinations does not impact students' success in chemistry exams. This indicates that a significant portion of teachers believe that practical resources might not be crucial for students' performance in exams, potentially suggesting alternative assessment methods or focusing on theoretical knowledge. 60% of the respondents agree with the statement that the lab technician has a significant impact on students' success in chemistry exams. This implies that a majority of teachers recognize the importance of the lab technician's role in facilitating students' practical experiences and supporting their understanding, which may contribute to better exam performance. 60% of the respondents agree with the statement that a laboratory technician needs to have the necessary training and skills to influence students' success in chemistry exams. This suggests that most teachers acknowledge the importance of a skilled and trained lab technician in guiding students effectively during laboratory sessions, potentially leading to improved performance in exams. Overall, the data indicates general agreement among the surveyed teachers on the importance of chemistry textbooks and study tools for students' performance, the significance of lab technicians in supporting students' success, and the requirement of appropriate training and skills for lab technicians. However, there is some disagreement regarding the impact of lacking access to practical resources on exam outcomes, with a relatively higher percentage disagreeing with this statement.

4.3 Summary of Data Analysis

The study analyzed 134 out of 144 questionnaires, which were the major source of primary data used in this study, hence data editing was applied as the first step of qualitative analysis. The data obtained from the questionnaires was critically examined to detect errors and the questions that were not answered properly, all the mistakes were corrected and poorly answered questionnaires were exempted from analysis process. The research applied qualitative data analysis methodology, where the quantitative analysis, regardless of the specific approach which involves; comprehending the phenomenon under study, synthesizing a portrait of the phenomenon that accounts for relations and linkages within its aspects, theorizing about how and why these relations appear as they do, and re contextualizing, or

putting the new knowledge about phenomena and relations back into the context of how others have articulated the evolving knowledge was applied.

4.4 Discussion of Findings

The study aimed at investigating the factors influencing students' low achievement in chemistry in public secondary schools in Athi River Sub County, Machakos County, Kenya, and propose solutions to improve the situation. The research was guided by four objectives, each focusing on different aspects of the problem.

The first objective was to establish the students' factors that influence their performance in chemistry during the Kenya Certificate of Secondary Education (KCSE) in the region. The study did not provide specific details about the identified factors, but it is reasonable to assume that age might play a role in academic performance. The data showed that a significant number of respondents were between the ages of 16 and 20, which suggests that this age group forms a significant portion of the student population. Further investigation into the relationship between age and chemistry performance could shed light on whether younger or older students tend to perform better in the subject. The study aimed to identify the factors related to teachers that influence students' performance in chemistry. The data presented the educational qualifications of school principals in terms of their degrees. It showed that a considerable number of principals held Bachelor's Degrees (40%) and Diplomas (40%), with a smaller percentage having Master's Degrees (20%). Although the data does not directly correlate principal's qualifications with chemistry performance, it could be useful to explore whether schools with principals possessing higher academic qualifications tend to have better chemistry performance.

The research sought to examine whether the performance in chemistry is influenced by resource access in public secondary schools in the study area. Unfortunately, the data provided did not include specific information about the available resources in schools. However, it mentioned that the study recommended investing in more instructional resources and infrastructure, which indicates that there might be a lack of resources affecting students' performance in chemistry. Further investigation into the type and availability of resources in schools could provide valuable insights into their impact on chemistry achievement.

The study aimed to identify the methods used by teachers in public secondary schools to improve chemistry performance. Unfortunately, the data did not elaborate on the specific

teaching techniques employed by educators. Understanding the teaching approaches that have been successful in enhancing chemistry achievement could be instrumental in developing effective strategies to improve student performance.

The data presented mean scores and percentages for different score ranges in overall KCSE and specifically in Chemistry across three years (2020, 2021, and 2022). It showed fluctuations in the performance of students in different score ranges over the years. Analyzing the performance trends can help identify patterns and potential factors influencing changes in chemistry achievement. The study provided valuable insights into the factors influencing students' low achievement in chemistry in public secondary schools in the study area. However, further research and analysis are required to draw more concrete conclusions and develop targeted interventions. Exploring the specific students' factors, teachers' factors, resource access, and effective teaching methods could contribute to the development of comprehensive strategies aimed at improving chemistry performance in Athi River Sub County, Machakos County, Kenya.

This finding agrees with findings by (Chesang Chepyegon, 2018) who found that teachers of chemistry receive in-service training on the importance that scientific terminology play, which incorporate specialized words in current teaching materials, and that languages teachers usually consult teachers and pass while managing special terminology. The study agree with studies by Adesoji (2018) who found that learners, instructor and educational situational variables are predictors of performance in senior secondary school chemistry in Oyo estate, Nigeria. Lastly the finding agree with studies by Jerry (2019) who found that lack of scientific supplies, a shortage of adequate and high-quality publications, the idea that science is difficult, students' lethargy, and just a lack of time to set out for practical teaching are all contributing factors to the drop in bad science achievement in Malawi.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section outlines the discussions, summary of findings (Answers to research questions), conclusions, recommendations, and suggestions for further research in relations to an investigation of factors influencing students' low achievement in chemistry in public secondary schools in Athi River Sub- County, Machakos County, Kenya.

5.2 Summary of findings (Answers to Research Questions)

5.2.1 Students' factors that influence the performance in chemistry in public secondary schools in Athi River Sub County, Machakos County, Kenya.

The study affirmed that students' factors influence the performance in chemistry in public secondary schools in Athi River Sub County, Machakos County, Kenya. An overwhelming majority of respondents (91%) agree that laboratory staff members need to receive training and certification in order to have an impact on students' performance in chemistry exams. Only a small percentage (9%) disagreed with this statement. Chemistry textbooks and study tools have a major impact on students' performance in chemistry exams, according to 80% of the surveyed teachers. This highlights the significance of using appropriate resources to enhance students' understanding and success in the subject. The data suggests that students' performance in Chemistry, as measured by KCSE scores, differs from their overall performance. In all three years, a higher percentage of students achieved lower scores (1.0-5.0 range) in Chemistry compared to their overall KCSE performance. However, there is an increasing trend in the percentage of students achieving higher scores (above 9.0) in Chemistry, particularly in 2022.

This findings concur with the findings by Balinda, (2019) that a shortage of adequate facilities for learning, culturally, philosophical, and monetary catastrophes, poor management of school funds, a lack of motivation on the part of both students and teachers, and poor educational outcomes on public high school examinations were all factors. As well as findings by Akram, & Ikram, (2017), found that Chemistry is a fundamental subject in secondary school, and it is essential for students who wish to pursue careers in science, engineering, and medicine. However, some students perform poorly in chemistry, and this has been a persistent challenge in public secondary schools.

5.2.2 Teachers' factors that influence students' performance in public secondary schools in Athi River Sub County, Machakos County, Kenya.

The study found that teachers' factors influence students' performance in Chemistry in Athi River Sub County, Machakos County, Kenya. This was evidenced by a majority of respondents (55%) who believe that learners perform better in chemistry exams when ICT resources are utilized in the classroom. However, it is worth noting that a significant portion (45%) disagrees with this statement. Other factors such as teaching methods, student engagement, and individual effort can also play significant roles in students' success in chemistry. A majority (70%) of the respondents believe that a lack of access to a lab, chemicals, and tools during practical examinations does not significantly affect students' success in chemistry exams. The lab technician's role is perceived as important by 60% of the teachers, as they believe that the lab technician has a significant impact on students' success in chemistry exams. This underscores the influence of a skilled and knowledgeable lab technician in facilitating practical experiences and supporting students' understanding. This suggests that alternative assessment methods or a stronger emphasis on theoretical knowledge may be considered by these teachers. From the data, the study found that opinions regarding the adequacy of teachers at the institution to teach chemistry are equally divided among the surveyed individuals. Half of the respondents perceive the teachers to be adequate, while the other half holds the view that they are inadequate.

This finding agrees with the finding in literature review by Nyamubi, (2017), on determinants of secondary school teachers' job satisfaction in Tanzania, who found out that teachers' factors influence students' performance in Chemistry. He recommended that classrooms and other teaching and learning materials be provided to encourage teachers and learners and thus enhance student achievement, and that head teachers must make sure that their institutions have the necessary tools and resources for teaching as well as that the teachers adequately cover the syllabus.

5.2.3 Access of resources and performance of chemistry in public secondary schools in Athi River Sub County, Machakos County, Kenya.

The researcher established that performance of Chemistry depends on the resource access in Athi River Sub County, Machakos County, Kenya. This was evidenced by a majority of respondents (55%) who believe that learners perform better in chemistry exams when ICT

resources are utilized in the classroom. However, it is worth noting that a significant portion (45%) disagrees with this statement. The majority of students (firmly concur + agree) indicate that their educational institution employs a scientist for the chemical department. However, there is a significant number of students who are unsure or disagree, suggesting some uncertainty or disagreement regarding the presence of a scientist in the chemical department of their institution.

This agrees with the findings in literature by Adesoji (2018) who conducted research on learners, teachers and educational situational variables as predictors of performance in senior secondary school chemistry in Oyo estate, Nigeria. Hence, it is believed that children who attend the school in an urban area, have access to a well-equipped lab, and have an interest in attending workshops will perform very well in chemistry. The study suggested that elected officials and those involved in the education industry should improve the learning experience for students. They ought to inspire teachers who carry out coursework.

5.2.4 Methods used by teachers and performance of chemistry in public secondary schools in Athi River Sub County, Machakos County, Kenya

The study found out that teachers use different methods to raise chemistry performance levels in public secondary schools in Athi River Sub County, Machakos County, and Kenya.60% of the respondents agree that a laboratory technician needs to possess the necessary training and skills to influence students' success on chemistry examinations. This emphasizes the importance of providing appropriate training and professional development opportunities for lab technicians to effectively guide students during laboratory sessions. The research suggested that a majority of the surveyed teachers (50%) strongly agree and additional respondents (20%) agree that the use of ICT in chemistry teaching and learning positively impacts students' success on chemistry examinations. This indicates a general consensus among the teachers that incorporating ICT tools and resources can contribute to improved student performance in chemistry exams. However, it's worth noting that a significant proportion (30%) of teachers strongly disagree with this notion, suggesting some variation in perspectives regarding the effectiveness of ICT in relation to students' exam outcomes.

These findings agree with findings in literature by Cyril & Lucas, (2017) who found that Academic success is hindered by a variety of problems, including: a shortage of educational settings that are favorable to studying, a lack of teaching and learning resources, and a dearth

of teachers compared to the amount of students for each topic. Lack of well-stocked libraries and laboratory, poor communication among teachers, families, and children, and poor classroom attendance by both teachers and students were other factors linked to this performance. In addition finding in literature by Ajayi (2017) who asserts that a chemistry teacher should strive to switch from lecturing to creative developing skills like cooperative learning and concept mapping by using improvised materials where there is no science equipment. Flexible teachers must employ cutting-edge teaching techniques that adapt the content to students with a variety of skills and talents.

5.3 Conclusions of the Study

The study concluded that students' factors, teachers' factors, resource access and methods of teaching influence chemistry subject performance levels in public secondary schools in Athi River Sub County, Machakos County, Kenya.

The majority of respondents showed a positive perception of using ICT materials and methods for education and learning in school, as well as the utilization of ICT tools by teachers of chemistry. This indicates a general acceptance and recognition of the benefits and effectiveness of ICT in the educational context. Respondents expressed satisfaction with the availability of chemistry textbooks, educational CDs, and learning resources, indicating that these materials are widely accessible for both teachers and students. Adequate access to resources is crucial for effective teaching and learning experiences. While there was a general agreement that there are enough substances and tools to finish chemistry practicals, there was also a notable proportion of respondents who disagreed or firmly disagreed with this statement. This suggests that some students may perceive a lack of resources and tools required for practical experiments in chemistry. The use of models, figures, and hands-on practical work in chemistry instruction received positive responses from a majority of respondents. However, there were also respondents who disagreed or firmly disagreed, indicating a diversity of opinions regarding the effectiveness of these instructional methods. Regarding the acquisition of instruction and skills required to use ICT successfully, a significant majority of students felt that they had acquired the necessary skills. However, a notable portion of students responded negatively, indicating a need for further instruction and skills development in utilizing ICT effectively.

Teachers prefer demonstration method compared to practical's despite the presence of equipped laboratories. The students therefore are not well versed with the practical dimension of Chemistry. This led to most of them saying that the practical's make Chemistry a difficult subject. Schools have a library which is not well equipped. The available texts however are relevant and student to book ratio is adequate the laboratory is well equipped but teachers prefer the demonstration method. Lack of the hands on approach has led to students perceiving the subject as difficult due to the presence of practicals. Therefore there is underutilization of the resources.

The students have a negative attitude towards Chemistry despite the fact thatthey are interested in careers that need the knowledge of Chemistry. Students' attitudetowards the subject has affected the performance in the subject. Lack of exposure of students to practical before K.C.S.E hence inability to tackle practical work well by students due to preference of demonstration method by teachers over practical approach. Inadequate reference textbooks in the laboratory hence lack of adequate individual revision by the students. Negative attitude of the students towards the subject especially towards the practical paper hence lack of interest in performing well in the subject especially in practicals.

5.4 Recommendations of the Study

From the conclusion, the following recommendations are made:

The school management should increase the availability of Chemistry textbooks in the library to provide students with a variety of instructional resources. Additionally, Teachers of chemistry must prioritize practical learning by conducting more individual practicals and adopting a hands-on approach in their teaching methods.

To improve students' attitudes towards Chemistry, teachers should organize motivation talks, aiming to dispel negative perceptions and create a positive learning environment. Furthermore, in collaboration with the school management, they should arrange educational trips to chemistry-based industries to inspire and engage students.

Emphasize the importance of integrating Information and Communication Technology (ICT) tools in chemistry teaching. Encourage teachers to incorporate ICT resources to enhance interactive and engaging lessons. Provide training and support to help teachers effectively utilize ICT in the classroom.

Despite differing opinions among teachers on the impact of practical resources on exam success, it remains crucial to ensure students have adequate access to laboratory facilities, chemicals, and tools. Schools should invest in resources and infrastructure to facilitate practical learning experiences, ultimately improving students' understanding and performance.

Acknowledge the significant role of lab technicians in supporting students' success. Offer ongoing professional development opportunities for lab technicians to enhance their knowledge, skills, and ability to guide students during laboratory sessions, positively influencing exam outcomes.

Encourage collaboration among teachers, lab technicians, and students to create a supportive and conducive learning environment. Open communication and cooperation are essential to provide the necessary resources and support for successful chemistry teaching and learning.

Conduct additional research to explore the impact of ICT integration, access to practical resources, and the role of lab technicians on students' success in chemistry exams. This research can inform future educational policies and practices. Implement differentiated instruction, leveraging ICT tools, and resources to cater to diverse learning styles and abilities, supporting students' success on chemistry exams. Continuously monitor and assess the impact of these strategies, gathering feedback from teachers, lab technicians, and students to identify areas of improvement and enhance the overall effectiveness of teaching and learning approaches.

5.5 Recommendations for further studies

The researcher suggests more investigation on why teachers prefer demonstration over individual practical's in schools with equipped laboratories, impact of teachers' intrinsic motivation on performance of Chemistry in PublicSecondary Schools and an assessment of teacher student ratio on performance of all examinable subjects in both private and public secondary schools in Kenya

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APPENDICES

APPENDIX I: Instruments of Data Collection (Principal's Questionnaire)

My name is Duncan Nzuki Kalani, and I'm a teacher and graduate student in the school of education at KCA University. I am carrying out a study on factors influencing low achievement in Chemistry in Public Secondary schools in Athi River Sub County, Machakos County, Kenya. One of the institutions selected for this study is your school. Please be honest in your responses to all of the questions in each area. Only this study will use the responses submitted. There are four sections in this questionnaire:

SECTION A: Background information.

Fill in the gaps or tick (√) inside the box where appropriate.

1. What is your gender?

Male ☐ Female ☐

2. What is the number of lessons in your institution?

Single ☐ Double ☐ Triple ☐ More than triple ☐

3. What is the gender of teachers who work in your institution? Males ☐ Female ☐

4. What is the gender of students who attend your institution? Boys ☐ Girls ☐

5. What is the highest academic degree you have earned??

Diploma ☐ Bachelor's Degree ☐ Master's Degree ☐

Any other, specify _____

6. What is the length of your teaching career?

1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ Over 20 ☐

SECTION B: How students feel about the study of chemistry

Where applicable, check (√) the corresponding box.

7. What do you think of students' attitudes regarding the study of chemistry?

Positive ☐ Negative ☐

8. How do you assess students' success in chemistry relative to their achievement in the remaining KCSE subjects? Better ☐ same as others ☐ bad ☐ worse ☐

9. (a) How is the mean score of chemistry and overall KCSE result for your institution from 2020 to 2022? Where applicable, check the box (√) in the table below.

		Mean Score				
	Year	1.0-3.0	3.1-5.0	5.1-7.0	7.1-9.0	Above 9.0
Overall KCSE performance	2020					
	2021					
	2022					
KCSE Chemistry Performance	2020					
	2021					
	2022					

(b) Does the students' view of chemistry affect how well they perform in chemistry exams? The answer is seen in the table above?

10. Can a student's impression in chemistry affect how well they perform in chemistry exams? Yes ☐ No ☐

SECTION C: Teachers' Qualification and experience.

You must check the relevant box next to the necessary response in this part of the form.

11. Are there adequate teachers in your institution to teach chemistry?

Yes ☐ No ☐

12. How would you rank the amount of work that teachers of chemistry have?

Heavy ☐ Moderate ☐ Low ☐

13. What is the length of time that your teachers of chemistry have been teaching?

1-4 ☐ 5-8 ☐ 9-12 ☐ 13-16 ☐ Over 16 ☐

14. How often do your teachers of chemistry attend professional development sessions, seminars, or workshops each year?

Often ☐ Moderate ☐ Rarely ☐ Not at all ☐

15. A grid of statements on a 1 to 5 scale make up this question. It has to do with the academic standing and teaching background of teachers of chemistry. Please mark (*) the response that most accurately expresses your thoughts on the following:
Chemistry students who are taught by teachers with the necessary training and expertise are well-prepared to pass the KCSE test in chemistry.
1- Strongly agree 2- Agree 3- Disagree 4= strongly disagree 5= neither agree nor disagree

		1	2	3	4	5
(a) Academic Qualification level	Masters					
	Degree					
	Diploma					
	Untrained					
(b) Teaching experience in years	1-4					
	5-8					
	9-12					
	13-16					
	Above 16					

16. Do you believe that students' success in chemistry is influenced by the academic credentials of their teachers? Yes ☐ No ☐
(b) Select the level that has the biggest impact on your success in chemistry if you answered "yes" to question (a) above. _____

SECTION D: The utilization of teaching and learning materials, ICT facilities, and their accessibility in impacting students' performance in chemistry.

17. This inquiry looks into the breadth of available resources and how they are used in your school. It comprises of sentences laid down in a grid with scales from 1 to 5. Please check the box next to the statement that best describes your view on it by clicking once.
1=strongly agree 2= Agree 3=Disagree 4=strongly disagree 5= neither agree nor disagree

	Statement	1	2	3	4	5

a)	The accessibility of ICT facilities and teaching/learning materials					
	A computer lab with adequate functional computers is available.					
	I make sure teachers of chemistry go to ICT meetings and classes when requested.					
	The availability of chemistry CDs and e-Books for teachers is acceptable.					
	I make sure there are enough chemical books for various modes of instruction.					
	I provide teachers and students with enough chemistry revision papers and booklets.					
	All courses have access to sufficient chemical laboratories.					
	To complete biochemistry practicums, there are sufficient chemicals and equipment.					
	There are sufficient libraries and classrooms for instruction and test preparation.					
	The right diagrams and models are available to teach chemistry.					
b)	Utilization of ICT resources and instructional tools					
	ICT resources can be used to teach chemistry by qualified teachers of chemistry.					
	I make sure that teachers of chemistry use ICT, including CDs and computers, when teaching the subject.					
	I make sure students use their textbooks and study guides to make sure they are adequately prepared for tests.					
	For better comprehension, I make sure chemical practicals are performed often.					
	To help students grasp what they are learning, chemistry professors utilize models and charts throughout class.					
	Students adequately utilize the classroom and library for review to boost their confidence before chemistry tests.					

18. Do you agree with the following statements?

(a) Learners do better on chemistry exams when ICT resources are used in the classroom?

Yes ☐ No ☐

(b) A laboratory technician is essential for improving students' performance in chemistry exams. Yes ☐ No ☐

(c) Laboratory staff members must get training and certification in order to impact students' performance on chemistry exams. Yes ☐ No ☐

19. List the strategies your institution uses to help students do better on chemistry exams.

_____

_____

_____

_____

_____

18. Provide further advice on how to help students perform better in Chemistry exams.

_____

_____

_____

_____

_____

END

THANK YOU FOR PARTICIPATING IN THIS STUDY

APPENDIX II: Instruments of Data Collection (Teacher's Questionnaire)

My name is Duncan Nzuki Kalani, and I'm a teacher and graduate student in the school of education at KCA University. I am carrying out a study on factors influencing low

achievement in Chemistry in Public Secondary schools in Athi River Sub County, Machakos County, Kenya. One of the institutions selected for this study is your school. Please be honest in your responses to all of the questions in each area. Only this study will use the responses submitted. There are four components to this questionnaire.

SECTION A: General information

Fill in the gaps or tick (√) inside the box where appropriate.

1. Which gender are you?

Male ☐ Female ☐

2. What number of lessons do you have in a week?

Below 15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ above 30 ☐

3. (a) Do you teach other subjects in forms 3 and/or 4 besides chemistry?

Yes ☐ No ☐

(b) Describe the subject if your response to 3(a) above is affirmative._____

SECTION B: The students' assessments of their performance in chemistry exams, Tick or fill in the blanks (√) where applicable.

5. How do you think students feel about chemistry?

Positive ☐ Negative ☐ neither positive nor negative ☐

6. Do you enjoy teaching chemistry? Yes ☐ No ☐

7. How would you rank your students' performance in chemistry in comparison to other scientific subjects on the KCSE exam?

Better ☐ Good. ☐ Same as others ☐ Worse ☐

8. (a) Do you believe that students' perceptions about chemistry have an impact on how well they do in exams? Yes ☐ No ☐

(b) If so, how much does the students' perspective influence their performance in chemistry in 8(a) Above? Small ☐ medium ☐ Large ☐

SECTION C: Teachers Qualification and Experience.

In this section, Tick (√) where appropriate

9. What is the highest degree you have ever earned?

Diploma ☐ Bachelor's Degree ☐ Masters ☐ any other, specify_____

9. How many years have you been teaching chemistry?

1-5 ☐ 6-10 11-15 ☐ over 15 ☐

10. How long have you been teaching form 3 and/or form 4 classes?

1-5 ☐ 6-10 ☐ 11-15 ☐ over 15 ☐

11. What percentage of yearly chemistry workshops, seminars, and training sessions for teachers'do you attend?

Often ☐ Moderate ☐ rarely ☐ never ☐

12. The responses below should be marked with a tick (√) based on how you feel about the ensuing statements?

a) The intellectual level of teachers affects students' performance on the high school chemistry test.

Strongly agree ☐ Agree ☐ Disagree ☐ strongly disagree ☐ Not sure ☐

b) The success of students on chemistry exams is determined by the amount of years that chemistry professors spend teaching chemistry.

Strongly agree ☐ Agree ☐ Disagree ☐ strongly disagree ☐ Not sure. ☐

c) Students' performance on chemistry exams is directly correlated with how frequently they attend in-service training, chemical workshops, and seminars.

Strongly agree ☐ Agree ☐ Disagree ☐ strongly disagree ☐ Not sure. ☐

END I APPRECIATE YOUR INVOLVEMENT IN THIS STUDY

APPENDIX III: Instruments of Data Collection (Student's Questionnaire)

My name is Duncan Nzuki Kalani, and I attend KCA University's School of education as a graduate student. I'm conducting research on the causes of poor chemistry performance at publicly funded secondary institutions in Kenya's Machakos County's Athi River Sub

County. Your school is one of the organizations chosen for this investigation. Please be truthful in your answers to each and every one of the queries. The answers provided will only be used for this research. This Questionnaire has five Sections.

SECTION A: Knowledge in Overview and Students' Views

Complete in each blank or mark the proper area with a (√) when necessary.

Enter all of the blank or mark each choice (√) as necessary.

1. Which sex are you?

? Male ☐ Female ☐

2. Chemistry is easier to understand than other science disciplines.

Completely concur ☐ concur ☐ Disagree ☐ Disagree vehemently Undecided ☐

3. (a) Do you particularly like Chemistry?

Significantly ☐ Modest ☐ Not much Absolute ☐

b) What influences your feelings in 3(a) above?

How are Chemistry topics and queries taught? ☐ Instructor of chemistry? ☐

Any other, please indicate _____

4. (a) Which of the three subjects—biology, physics, or chemistry would you prefer to see at your school?

Biology ☐ Physics and Chemistry ☐

b) Explain your response to question 4(a) above.

_____

5. In what ways do you concur with the statement "My understanding of chemistry influences how I perform on the chemistry exam"?

Wholeheartedly concur ☐ concur ☐ disapprove ☐ vehemently dispute ☐

Uncertain ☐

SECTION B: DATA RELATING TO LEARNING ASPECTS

Complete every empty blank or mark each option () as necessary.

5. Since you first registered in your school, what number of teachers of chemistry have there been at your school?

1☐ 2☐ 3 ☐ 4☐ over 4 ☐

6 (a) How would you assess your school's overall exam performance?

Very good ☐ Good ☐ Average ☐ Poor ☐ Very poor ☐

(b) What score would you give the science curriculum at your school?

Really excellent ☐ satisfactory,☐ typical, or poor ☐ really awful ☐

7 a) How frequently do you take chemistry quizzes or examinations that are term-based?

Always use moderation☐ hardly ☐ never at all ☐

b) Once you do a test, do you go over the questions you didn't comprehend with your teacher or on your own?

Perpetually ☐ Low☐ only occasionally☐ Never at all ☐

8. How much do you concur with this assertion?

"My teachers of chemistry significantly help me to pass chemistry exams."

Firmly concur☐ concur☐ disapprove☐ Not at all agreeable.☐ Absolutely disapprove.

SECTIONC: INFORMATION AND COMMUNICATIONS TECHNOLOGY INSTRUCTIONAL AND INSTRUCTIONAL MATERIALS, AS WELL AS THEIR UTILIZATION IN BIOCHEMISTRY

9. This topic is composed of a grid with assertions numbered from 1 to 5. Make sure to put an asterisk (*) next to the school-related remark that most accurately reflects your viewpoint.

1 means firmly concur 2=Agree 3=Disagree 4 means firmly disagree 5 = unsure

For example

	1	2	3	4	5
In my classroom, review tools for chemical reactions are sufficient.	√				

The reaction in this case indicated that the educational institution has a wealth of biochemistry review resources, making it simple for any student to get those materials whenever they need them.

Entrance to a variety of electronic resources, teaching aids, and cognitive instruments

	Statement	1	2	3	4	5
I	There is a processing facility and enough working computers at my training establishment.					
ii	Biochemistry can be taught by the teacher(s) or using a machine lacking any issues.					
iii	You'll find sufficient Disks and digital texts for instructing chemical online.					
iv	Any kind of science in my institution have sufficient resources.					
V	Students have access to enough previous essays and textbooks for science preparation.					
vi	It has sufficient labs to learn science.					
vii	For all science tasks, you'll require sufficient materials and supplies.					
viii	Our educational institution employs a scientist for the chemical department.					

b) Utilization of information and communication technologies and teaching and learning tools

1 means firmly concur 2=Agree 3=Disagree 4 means firmly disagree 5 = unsure

	Statement	1	2	3	4	5
	Computing facilities are occasionally used by science teachers to instruct the subject.					
ii	Tech is occasionally made available to students so they can study chemical reactions using Discs and computerized resources.					
iii	Students apply texts and study guides to adequately prepare to take science examinations.					
iv	Students fare best in chemistry examinations when they use electronic resources like Disks or different tools.					
v	Science laboratory work is very important for students to succeed in chemical exams.					
vi	Scientists contribute significantly to how well students do on science exams.					

10. What drives do you believe children struggle in science tests?_____

_____

_____

11 Identify any strategies you employ to increase your performance on field evaluations.

_____

_____

_____

12. Give more advice regarding how to improve students' success on science tests.

_____

_____

_____

SECTION D: THE COMPLETION OF ICT FACILITIES, CLASSES RESEARCH, AND APPROACHING SERVICES, INCLUDING THE USE OF THESE Materials IN IMPACTING CHEMISTRY PERFORMANCE

This issue looks into the range of tools that are accessible and how they are used in your school. It consists of words in grid style, ranging from 1 to 5. To the assertion about your institution that most closely reflects your answer, please check the box next to it. ().
1 means firmly concur 2= Agree 3=Disagree 4 means firmly disagree 5 means that you are indifferent.

	Statement	1	2	3	4	5
a)	utilization of a variety of ICT materials, learning resources, and teaching aids					
i	possession of a variety of ICT materials, learning resources, and teaching aids					
ii	Teachers of chemistry take part in ICT seminars and classes when asked.					
iii	Chemistry textbooks and educational CDs are widely available for teachers.					
iv	There are enough chemistry texts available for all types of students.					
v	For chemical review, students have access to plenty of old papers and texts.					
vi	Chemical labs are accessible for all classes.					
vii	There are enough substances and tools to finish the chemistry practicals.					
viii	The number of classrooms and libraries needed for teaching and exam preparation is adequate.					
ix	There are adequate illustrations and models to teach chemistry.					
b)	the use of ICT materials and methods for education and learning					
i	Competent teachers of chemistry can teach chemistry using technology.					
ii	. Teachers of chemistry use ICT to instruct the topic by utilizing CDs and laptops					

iii	To properly prepare for chemistry exams, students use texts and study materials.					
iv	. Chemistry practicals are frequently carried out in order to improve understanding.					
v	Teachers of chemistry use models and figures frequently during instruction to help students understand what they are experiencing.					
vi	In order to enhance their trust before chemistry exams, students make effective use of the classroom and library for review.					

17. (a) Have you gotten the instruction and skills required to use ICT successfully while chemistry is being taught and learned through seminars? Yes ☐ No ☐

(b) If the response to question 17(a) above is "yes," how much do you use ICT to teach and study chemistry during the lesson?

Always ☐ moderate ☐ rarely ☐ never ☐

18. Do you think that students' success on chemistry examinations is impacted by the use of ICT in chemistry teaching and learning??

Strongly agree ☐ Agree ☐ Disagree ☐ strongly disagree ☐ Not sure. ☐

19. (a) Does your school employ a laboratory technician??? Yes I☐ ☐

(b) If your answer in (a) above is yes, is s/he Trained and qualified? Yes ☐ No

20. Mark () to denote when each of these assertions is true (T) or untrue (F): a) the use of chemistry textbooks and study tools by students has a major impact on their performance on chemistry exams T F

b).. Lack of access to a lab, chemicals, and tools when taking practical examinations has no impact on students' success on chemistry exams T ☐ F ☐

c). the lab technician has a significant impact on students' success on the chemistry exam.

T ☐ F ☐

d). A laboratory technician needs to have the necessary training and skills to influence students' success on chemistry examinations. T ☐ F ☐

SECTION E: METHODS EMPLOYED TO IMPACT EDUCATION

SUCCESSFUL CHEMISTRY ANALYSIS

21. Share some illustrations of the techniques you use to help students do improved on chemistry examinations.

_____

_____

_____

17. What strategies do you think students in your school use to improve their performance on chemistry exams?

_____

_____

_____

18. Give more tips on how to help students do better on the KCSE Chemistry test.

_____

_____

_____

END

I APPRECIATE YOUR INVOLVEMENT IN THIS STUDY.

APPENDIX IV: RESEARCH PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: **248830**

Date of Issue: **05/June/2023**

RESEARCH LICENSE

This is to Certify that Mr.. DUNCAN NZUKI KALANI of KCA University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Machakos on the topic: AN INVESTIGATION OF FACTORS INFLUENCING STUDENTS' LOW ACHIEVEMENT IN CHEMISTRY IN PUBLIC SECONDARY SCHOOLS IN ATHI RIVER SUB- COUNTY, MACHAKOS COUNTY, KENYA. for the period ending : 05/June/2024.

License No: **NACOSTI/P/23/26259**

248830

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

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See overleaf for conditions

APPENDIX V: APPROVAL-ATHI RIVER SUB COUNTY

KCA UNIVERSITY

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Website: www.kca.ac.ke

BOARD OF GRADUATE STUDIES

KCA/SGS/May. 23/1

15th May 2023

FORWARDED
SUB-COUNTY DIRECTOR OF EDUCATION
ATHI RIVER
P. O. Box 114 - 00204, ATHI RIVER
FORWARDED AND APPROVED

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: DUNCAN NZUKI KALANI REG. NO: 22/00923

It is my distinct pleasure to introduce to you Duncan Kalani who is a student in our institution pursuing a Master of Education in Leadership and Management in the School of Education, Arts and Social Sciences.

Duncan is conducting a research on a topic titled: ***"An Investigation of Factors Influencing Students' Low Achievement in Chemistry in Public Secondary Schools in Athi River Sub- County, Machakos County, Kenya."*** which is part of the requirements of the program he is pursuing. The research as well as the data procured thereof shall be used for academic purposes only.

Any assistance accorded to him is highly appreciated.

In case of further inquiry, do not hesitate to contact the undersigned.

Yours faithfully,

Dr. Jackson Ndolo
Director, Board of Graduate Studies

APPENDIX VI: TIME FRAME

EVENT	TIME FRAME
Proposal Writing	January 2023- April, 2023
Data Collection	May 2023- June, 2023
First rough draft presentation	Mid June, 2023
Second Rough draft presentation	July-August, 2023
Third Rough Draft Presentation	September, 2023
Final Submission of Project copy	October, 2023
Graduation	November/December, 2023

APPENDIX VII: BUDGET

ITEM DESCRIPTION	ESTIMATED AMOUNT(SHS)
Proposal Writing	5,000
Developing data collection instrument	10,000
Research assistant expenses	10,000
Data collection exercise	10,000
Rough draft writing (three times)	30,000
Final project work compiling	10,000
Miscellaneous	10,000
TOTAL	85,000