FACTORS INFLUENCING LEARNERS' ACADEMIC ACHIEVEMENT IN CHEMISTRY IN PUBLIC DAY SECONDARY SCHOOLS IN NANDI EAST SUB COUNTY, NANDI COUNTY, KENYA

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DECLARATION

This project report is my original work and has not been presented for any academic award at any university.

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To my beloved husband, John Chepkwony and our children, Faustina Jepkirui, Mediatrix Jerotich and Bridgit Jeruto.

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ABBREVIATIONS AND ACRONYMS

CATS: Continuous Assessment Tests

CBC: Competency Based Curriculum

DOS: Director of Studies

EFA: Education for All

KCPE: Kenya Certificate of Primary Education

KCSE : Kenya Certificate of Secondary Examination

KNEC : Kenya National Examination Council

MOE: Ministry of Education

PDSS: Public Day Secondary School

SDG: Sustainable Development Goals

SPSS: Statistical Package for Social Sciences

STEM: Science Technology Engineering and Mathematics

TSC: Teachers Service Commission

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ABSTRACT

Globally, Chemistry is an important science subject that accounts for technological knowledge in developed countries and by extension developing countries. Chemistry is one of the core subjects taught in secondary schools in Kenya. There has been frequent low academic achievement by the learners in Chemistry in Kenya Certificate of Secondary Education (KCSE) in the 8-4-4 education system which has lowered the morale of learners and teachers. This has led to a debate on factors that are responsible for these low achievements. The purpose of this study was to investigate factors influencing learners' academic achievement in Chemistry in KCSE in Nandi East Sub-county. The specific objectives of the study were: to establish the influence of teacher characteristics, to determine the influence of adequacy of teaching and learning resources, to establish the influence of learner characteristics and to establish the extent to which the learning environment influence learners' academic achievement in Chemistry in public day secondary schools in Nandi East Sub County. This study was guided by Clark Hull's reinforcement theory; and the study used Ex post facto research design. The significance of the study was to generate new knowledge in the field of curriculum studies. The study target population was 1160 students, 20 chemistry teachers, and 20 principals. A sample size of 18 public day secondary schools was selected for this study. A total of 255 learners were selected proportionately, while eighteen chemistry teachers and 18 principals sampled purposively making a total of 291 respondents. Simple random sampling technique was used in selecting the learners who took part in the study. Data was collected using two sets of questionnaires, interview schedule and document analysis. Validity and reliability of these instruments was ascertained before the actual data collection in the field. Pilot testing was done in Nandi Central Sub County. The study collected both qualitative and quantitative data. The qualitative data was analysed by creating relevant themes, while quantitative data was analysed using descriptive statistics and multiple regression analysis. The study established that Teacher characteristics had a positive and significant effect on learners' academic achievement of (β=.297, $p < 0.05$) and that learner characteristics had a positive and significant effect on learners' academic achievement of (β=.828, $p < 0.05$). The study further concluded that Learner characteristics and learning environment affects learners' academic achievement. The study recommended that Chemistry teachers should regularly attend in service trainings so as to improve their skills in teaching. Charts, models and other teaching aids should be used during chemistry lessons because they enhance learners' academic achievement.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Globally, Chemistry is among science subjects that plays a significant role in learners' future career aspiration even as it is deemed a challenging course of study (Sirhan, 2020). In USA, Vilia et al. (2021) posit that most public schools had been recording an improvement in academic achievement of students in chemistry in the last one decade. Factors such as teacher characteristics affect learners' academic achievement in Chemistry. In India, Tanwar (2021) posits in both public and private secondary schools, there is a significant difference between students' academic achievement in chemistry as well as teacher characteristics. The factors that influence learners' academic achievement in Chemistry in Public Day Secondary Schools include teacher characteristics, adequacy of teaching and learning resources and learner characteristics among others.

In Nigeria, Akani (2020) opines that in secondary schools, Students' academic achievement in Chemistry differs from one public school to the other. While the academic achievement of the students in Chemistry in some schools is high, in other schools it is low in Ebonyi State. The scholar further posits that learners' academic achievement in Chemistry is influenced by adequacy of teaching, learner characteristics and learning environment. In Kenya, Alavi, and Hoseini (2022) opined that Chemistry is a curriculum whose academic achievement depends on learners' competencies in areas such as making

observations while doing experiments, and deriving innovations from its results and findings. Chemistry subject is one of the compulsory and a basic subject taught in Kenya secondary schools' curriculum, since it plays an important function in society. In this regard, a study in Chemistry is necessary for meeting our basic needs of food, shelter, clothing, energy, health, clean air, water and soil. Through chemical technologies that emerge globally, the living standards of people can be improved and life challenges that arise from health, land, air and water as a result of use of materials and energy conversions can be solved. Study of chemistry also provides information about the universe we live in.

Olubu (2020) observed that industrial and analytic chemistry formed the basis of wide operational processes for the production in the manufacturing, engineering and capital goods. Chemistry offers a wide range of career opportunities especially in the field of Science, Technology, Engineering and Mathematics (STEM) and among others which are available in most of the universities. It is thus a requirement for a student who wishes to pursue these careers, to exhibit high academic achievement in Chemistry subject.

Some researches have been conducted on factors influencing the academic achievement of students in their summative evaluation. The findings from these researches cite number of variables that may have led to low academic achievement (Simiyu, 2019). Teacher characteristics such as education level, years of service and in-service training attended may have influenced the

academic achievement of the learners. Ogutu (2020), cited inadequate teaching and learning resources, chemicals and textbooks lead to ineffective teaching of Chemistry. Therefore, competent and adequately trained teachers will work towards achieving best school performance in learner academic achievement in Chemistry. Additionally, she posits that regular in-service trainings of teachers endow them with new knowledge, abilities, and competencies thus enhancing teaching and learning activities in their areas of practice.

The learning environment of the learners however plays a crucial role in ensuring that learning has occurred. Learner characteristics such as attitudes towards a subject and career aspiration may lead them to dislike the subject, subsequently leading to low academic achievement in Chemistry (Cherop, 2023). Teachers are therefore encouraged that during teaching and learning process more practical work should be done in Chemistry subject. And that they should put more emphasis on stating the observation and inferring, data manipulation, graph drawing and calculations. In Nandi County, the performance of students in Chemistry in KCSE is low in most public secondary schools (Kirwa, 2023).

The Table 1.1 below shows learners academic achievement in Chemistry in Kenya Certificate of Secondary Education (KCSE) for the year 2018, 2019 2020, 2021 and 2022.

Table 1.1: KCSE Chemistry results for the past five years in Kenya.

Year	Candidature	Maximum Score	Mean Score	National Mean score %
2018	656, 163	200	53.76	26.88
2019	619,802	200	52.17	26.09
2020	740,831	200	45.01	22.50
2021	820,765	200	42.02	21.01
2022	875,555	200	48.05	24.03

(Source KNEC Chemistry Report 2022)

According to Kenya National Examination Council (KNEC) report, there was a decline in the academic achievement of learners in Chemistry from 26.88% in 2018, 26.09% in 2019 to 22.50% in 2020 and 21.01% in 2021 and 24.03% in 2022. The KCSE Chemistry results in Nandi East Sub County have been declining too as in the Table 1.2 below. The KCSE mean grade of Chemistry subject of Public Day Secondary Schools in Nandi East Sub county are shown below.

Table 1.2: Chemistry mean grade in KCSE for the past five years

Year	Mean score	Mean grade
2018	2.66	D
2019	2.60	D
2020	2.33	D-
2021	2.18	D-
2022	2.54	D

(Source: Nandi East Sub County office, KCSE results archive, 2018-2022)

It can be noted that the mean grade has been dropping and it is generally low. The mean grade that reflects enhanced academic achievement in chemistry in KCSE is C+, however based on the statistics stated above, the current study undertook to investigate the factors that influence learners' academic achievement in Chemistry in Nandi East Sub County, Nandi County.

1.2 Statement of the problem

From the foregoing background, it is noted that the mean score in percentage for learners in Chemistry in the country has been dropping from 26.88% in 2018, 26.09% in 2019 to 22.50% in 2020, 21.01% in 2021 and 24.03% in 2022. The previous academic achievement in Chemistry for the past five years in a row has remained below average. In Nandi County, and nationally, statistics from KNEC have indicated dismal performance. From the foregoing data in the background of the study, there is low academic achievement of the learners' in Chemistry in KCSE in the 8-4-4 education system. This may be attributed to teacher/learners characteristics, availability of the teaching and learning resources and the learning environment. This is an important study since it forms a foundation for learners' success in the 21st century especially in STEM career orientation. Academic achievement in Chemistry is important as it might strengthen the Competence-Based Curriculum (CBC) in science subject. Academic achievement in Chemistry endows one with developmental skills drawn from science subjects which might help students to apply the competencies acquired to real-life situations. Therefore, there was need to establish the underlying factors that contribute to low academic achievement of Chemistry in Public Day Secondary Schools in Nandi East Sub County.

1.3 Purpose of the study

The purpose of this study was to investigate factors influencing learners' academic achievement in Chemistry in KCSE in Public Day Secondary Schools in Nandi East Sub County, Nandi County, Kenya.

1.4 Objectives of the study

The objectives of this study were:

i. To establish the influence of teacher characteristics on the learners' academic achievement in Chemistry in Public Day Secondary Schools in Nandi East Sub County.

ii. To determine the influence of adequacy of teaching and learning resources on learners' academic achievement in Chemistry in Public Day Secondary Schools in Nandi East Sub County.

iii. To establish the influence of learner characteristics and learners' academic achievement in Chemistry in Public Day Secondary Schools in Nandi East Sub County.

iv. To establish the extent to which the learning environment influence learners' academic achievement in Chemistry in Public Day Secondary Schools in Nandi East Sub County.

1.5 Hypotheses

The study was guided by the following hypotheses:

$H_0$1 There is no significant relationship between teacher characteristics and the learners' academic achievement as measured by mean grade in Chemistry in KCSE.

Ha1 There is a significant relationship between teacher characteristics and the learners' academic achievement as measured by mean grade in Chemistry in KCSE.

$H_0$2 There is no significant relationship between adequacy of the teaching and learning resources and the learners' academic achievement as measured by mean grade in Chemistry in KCSE.

H_a2 There is a significant relationship between adequacy of the teaching and learning resources and the learners' academic achievement as measured by mean grade in Chemistry in KCSE.

$H_0$3 There is no significant relationship between the learners' characteristics and the learners' academic achievement as measured by mean grade in Chemistry in KCSE.

H_a3 There is a significant relationship between the learner characteristics and the learners' academic achievement as measured by mean grade in Chemistry in KCSE

$H_0$4 There is no significant relationship between learning environment and the learners' academic achievement as measured by mean grade in Chemistry in KCSE.

H_a4 There is a significant relationship between learning environment and the learners' academic achievement as measured by mean grade in Chemistry in KCSE.

1.6 Significance of the study

Given the significance of STEM, this study helped generate information that may be used to make decisions for establishing and maintaining adequate teaching and learning resources for Chemistry and by extension STEM career aspiration. The study will provide knowledge that could be used to enhance teaching and learning process and environment. Additionally, the findings of this study will be published and the recommendation can be shared with parents, teachers and learners for future reference. The policy makers may find the findings useful on ways of improving curriculum implementation. Moreover, the information will be used to enhance teacher practice in the teacher-education practice

1.7 Limitations of the study

The study was limited in scope as it focused on one sub-county in Nandi County and yet there are several sub-counties in Nandi County. However, part of the sampling techniques adopted were probabilistic sampling techniques which helped to limit the level of bias and therefore enhanced generalizability of the findings to other sub-counties in Nandi County, other Counties and public secondary schools around the world. Anxiety among the learners was noticed during the filling of the questionnaires; however, the researcher established a good rapport to reduce it.

1.8 Delimitations of the study

The research was carried out in selected Public Day Secondary Schools in Nandi East sub county, Kenya. Form four students, chemistry teachers and principals were the respondents. Form four students are exposed longer and

they comprehend well the factors that may affect their academic achievements in Chemistry in the year of examination. The study was guided by ex-post facto design.

1.9 Basic assumptions

The study was based on the following assumptions:

i. -that the public day secondary schools selected teach and examines Chemistry subject,
ii. -that the learners and teachers will provide unbiased data,
iii. -that the reliable and valid measure of student academic achievement is KCSE.

1.10 Definition of significant terms

Academic achievement refers to the learner outcome in terms of grades learners attain in Chemistry subject in a national examination in relation with continuing one's career aspiration.

Adequacy of teaching and learning resources is the availability of the required teaching and learning resources that facilitate learning processes in view of improving academic achievement of the learners.

Chemistry refers to one of the compulsory sciences subjects a learner is required to study while in secondary school in Kenya. It entails use of process skills such as experimenting, observing and inferring in order to obtain knowledge. It is a component of the science-based learning area in the CBC.

Factor refers to circumstances or influence of the respondent and place of learning. In this study, these influences include learner factors, teaching and learning resources teacher characters and learning environment

Learner refers to one who is undertaking the learning process in a learning institution under the guidance of a teacher in preparation for the KCSE.

Learning environment refers to interactive process of the learner and the teacher with the learning resources with the view of attaining the learning objectives in readiness to undertake the KCSE.

Learner characteristics refers to the personal qualities of a learner they include age, attitude, entry behaviour, and career aspiration that affect learner academic achievement in Chemistry.

Practical refers to teaching and learning activity where a learner is expected to make observation, record and interpret the findings. It is mostly carried out in the laboratory, classroom or in the open and examined in the KCSE to ascertain the level of academic achievement.

Teaching and learning resource these are items and apparatus that facilitate teaching and learning processes in a classroom. They also include the learner and the teacher.

Teacher characteristics refer to the qualities of a teacher in terms of age, gender, academic qualities and teaching experience.

1.11 Organisation of the study

The study comprises five chapters which include; introduction, literature review, research methodology, data analysis, interpretation and discussion and summary, conclusions and recommendations. The following sub-topics are covered in chapter one; background of the study, statement of the problem, purpose of the study, objectives of the study, hypotheses, and significance of the study among others. In chapter two, the sub-topics include; empirical

review of literature on various variables adopted in the study, theoretical framework, conceptual framework and summary of literature reviewed. In chapter three, the sub-topics include; research design of the study, target population, sampling procedure and sample size, research instruments, validity and reliability of the research instruments among others. In chapter four, the sub-topics include; response rate, demographic information of the respondents, descriptive statistics findings on the study variables as well as discussions on the study variables. The correlation and regression analysis findings were also provided. In chapter five, the sub topics include; summary, conclusions and recommendations among others.

CHAPTER TWO

REVIEWED LITERATURE

2.1 Introduction

This chapter deals with the reviewed literature on various aspects as enlisted below.

2.2 The concept of Factors and Academic Achievement

Academic achievement refers to a standard in terms of grades assigned to Chemistry marks attained by a learner in an examination in Kenya. KCSE examination is done after completion of form one to form four coursework in the compulsory and selective subjects (Cherop, 2023). Therefore, the learners' mean grade shows the intensity of knowledge and skills acquired while undertaking the secondary curriculum. According to, Simiyu (2019), learners' academic achievement refers to the KCSE mean grade attained by a learner in Chemistry subject.

In another study by Bittok (2019), learners' academic achievement is influenced by the learning environment which includes availability of teacher-learner ratio. Furthermore, inadequate reference textbooks in the library act as major contributors to poor academic achievement in Chemistry (Kyalo, 2020). Moreover, Ogutu (2020) argues that inadequate provision of teaching and learning materials, laboratory chemicals and textbooks lead to poor academic achievement in Chemistry. She further suggested that large workloads and other administrative responsibilities could affect effective teaching of the teachers in their subject areas.

Additionally, some research findings have listed other factors that influence academic achievement of learners. A study done by Ahmed, Abdallah, Asia and Ali (2021), held that availability and adequacy of institutional resources and class size, text book-student ratio, adequacy of library and laboratory services, good leadership within the school, effective learner-instructor ratio, and re-tooling of instructors are various factors influencing learner preparation for KCSE and eventually their academic achievements in Chemistry.

2.3 Teacher Characteristics and Academic Achievement

Globally, Chemistry teachers are a vital resource in the classroom instruction process. They are the implementors of Chemistry curriculum and through their knowledge, skills, attitude, training and dedication; teachers can improve the academic achievements of learners in their respective working stations. Research done by Bhai & Horoi (2019) on teacher characteristics and academic achievements, revealed that characteristics of the teacher such as level of education, years of service and membership of a professional body influence favourably learner academic achievement. They found out that having a competent instructor both in Mathematics and English raised student achievements from 0.04 to 0.18 standard deviations. It is in order to have it that an experienced teacher devices way of making the lesson more productive.

Additionally, Muse, Ndirangu and Imonje (2019), held that the steady increase among secondary school learners as a result of launch in Free Primary Education (FPE) and Subsidized Secondary Education (SSE) has put the school management on toes to construct more learning spaces to accommodate the number of learners being enrolled. As enrolment increases, it can be observed that the number of teachers in an institution should also be increased and subsequently reducing their workloads. Ample workloads equal to effectiveness and efficiency in teaching and learning process and subsequently better academic achievements. However, inadequately skilled teachers, little instruction skills and limited experience may have been possible reasons for the low academic achievement of learners (Ojukwu, 2022). Teacher qualification is an important factor of concern for achieving better academic achievements among learners.

A study done by Copriady, Zulnaidi and Amini (2021), recommended that teachers in Chemistry who have less classroom experience needed further in-service preparation and cooperation to improve their skills and competencies. They added that seasoned teachers also need in-service coaching. In-service training programme serves to improve the skills and competencies of a teacher in the management of classroom, interaction with the learners and consequently improving academic achievement of the learners (Junejo, Sarwar & Ahmed, 2019). In New York, policy makers have encouraged teachers to have a master degree while others argue that they enrol for short courses enriched with different competency skills. Identifying teacher characteristic

which influence academic achievement can potentially illuminate the source of poor academic achievement. Therefore, teacher qualification is one of the crucial factors influencing mean grade in Chemistry

Tutors who have many years of experience in teaching are able to produce good quality grades among the learners. It has been observed that the tutors' instruction style greatly influenced the student academic achievement if practiced systematically. Ugwe (2023); Adiele (2021), in their study concluded that the teaching behaviour or style, mode of communication used by the teacher, and also time management enables the teacher and the learner to exchange ideas.

In this regard, learners acquire more skills, knowledge and values from teachers with strong academic skills which are earned through the years of practice. According to KNEC (2021), instructors should do their level best to inculcate basic knowledge in their learners by equipping the laboratory services. This study intends to look into these teacher characteristics which include level of education, in-service attended, teacher-student ratio and years of service and its influence on the learners' academic achievements.

2.4 Teaching/Learning Resources and Learners' Academic Achievement

A study done by Isiola (2022), opined that the instructional materials which include visual and non-visual aids, textbooks, objects or devices, can facilitate teaching and learning process in a classroom. Moreover, high academic

achievement is associated with accessibility and use of textbooks. Adequate supply of textbooks, immediate distribution and use of these learning resources enables schools to provide high academic service among learners consequently production of better academic achievement by learners (UNESCO, 2020).

From a study in Nigeria, Takwate (2018), showed that there a significant relationship between availability of instruction materials and learner mean score in that region. Therefore, institutional management had to improve the infrastructure present in the schools and allocate funds for the management of the same. Additionally, inadequate laboratory services and textbooks lead to low academic achievement due to poor delivery of the subject (Ahmed et al., 2021).

Furthermore, Yusuf (2022) argues that crowded classrooms hinder smooth teaching and learning process and that a teacher may not be able to reach out to every learner's interest, abilities and weaknesses. As the government of Kenya is implementing the Education for All (EFA) policy, there has been a tremendous enrolments rate in secondary schools leading to overcrowded classrooms. These consequently affect the learners' academic excellence and his or her future academic achievement in major exams.

Teachers are a vital resource in the instruction process. However, improving the number of teachers necessitate plans for up scaling too. In most cases,

school management has resorted to hiring individuals without qualifications and training in the move to reduce teacher shortage. These in turn hamper the learners' academic achievements. In Nandi North Sub County, Bittok (2019), observed that majority (70.6%) of the learners in secondary schools reported that there were inadequate Chemistry teachers in their schools. Inadequacy of Chemistry teachers leads to inadequacy of instruction in Chemistry (Njagi, & Silas, 2021). Moreover, this leads to poor Chemistry syllabus coverage and consequently poor academic achievements of learners in their exams and KCSE mean grade. Subsequently, improving the teacher's professionalism increases the chances of new enrolment and promotion. Teacher members will be satisfied, motivated and will work towards achieving quality grades. High performances from the teacher translate to better academic achievement of the learner in Chemistry subject. This study established the extent to which availability and adequacy of Chemistry teaching and learning resources influences learner's academic achievement in Chemistry in Nandi East Sub County.

Thuranira, Ikiara, and Thuba (2022) examined the influence of teaching learning resources on academic achievement among Public Primary Schools in Laikipia West Sub-County. The study adopted a descriptive survey research design and targeted 490 teachers drawn from 49 public primary schools. The study sampled 220 teachers and 10 head teachers who were selected randomly. The study used primary data which was collected using questionnaires and analysed both descriptively and inferentially. The study established that

teaching learning resources has a great influence on academic achievement. The study had not provided justification for the research design adopted and therefore a methodological gap exists which the current study sought to address.

Otieno (2021) studied Teaching/learning resources and academic performance in mathematics in secondary schools in Bondo District of Kenya. The study adopted descriptive survey research design and targeted 242 students but ended up sampling 121 students randomly. Data gathering was by use of questionnaires and analysed descriptively and inferentially. The study established that Teaching/learning resources enhances academic achievement. A contextual gap exists as the study focused on mathematics while the current study focused on Chemistry.

2.5 Learner Characteristics and Learners' Academic Achievement

Attitude is a major factor affecting teaching and learning processes. General perception of a learner towards Chemistry indicates learners' readiness to pursue excellence in Chemistry. According to Halladyna, and Shaughness (2021) as referenced by Ogembo, Otunga, and Taki (2020), learner attitude is related to the following factors: teaching method, teachers' perception of the learner, parental background, age, gender, earning modes of a student, future aspirations and significance of Chemistry as perceived by the society. Langat (2021), observed that the learning outcomes of a learner improves with the value attached to Chemistry subject at individual level. However, several

studies done in countries such as Brazil have found out there is a high correlation between learners with good perception towards Chemistry and their Chemistry achievements. The study further concludes that high academic achievement can easily be attained as long as the learners develop a positive attitude towards Chemistry subject (Diana, 2022).

Gender of the student also has an impact on the learners' academic achievements in Chemistry. Bittok (2019) posits that female students had a more negative attitude towards the importance of Chemistry in their live future work. This therefore shows that they will not try to learn and understand the meaning of Chemistry concepts that are being taught. The career choice of a learner in Chemistry influences the learners' academic achievements in Chemistry subject. A study carried out in Tanzania by Diana (2022), on the relationship between a career choice and student achievement found out that one's' career choice is greatly affected by their mean grade posted in Chemistry. In Kenya, a research was done in Trans-Nzoia County by Cherop (2023), on the relationship between students' career aspirations and student achievements in Chemistry, concluded that students' career aspiration is strongly connected to his or her academic achievements in Chemistry. Therefore, student academic achievement in Chemistry subject has an impact on their career choice later in life.

There are other factors affecting student academic achievements. They include: distance from home and learners' socio-economic background. It is

evident from previous studies that school location influences participation of learners in schools and subsequently in academic achievement (Ebinum, Akamagune, & Ugbong, 2020; Thapa, 2019; Getachew, 2022). Whereas learner's academic achievement may have been influenced by school location, other factors may also be responsible therefore the need to investigate. Currently Public day secondary institutions are encouraged to enrol learners with 300 marks and below out of 500 marks in KCPE. Hence there is need for value addition to the learner entry grades especially in KCSE. This study endeavours to investigate how these learner characteristics influences learner academic achievements in Chemistry.

Nakayama, Yamamoto, and Santiago (2018) studied the impact of Learner Characteristics on learning academic achievement in Hybrid Courses among Japanese Students. The study used descriptive research design and targeted 84 respondents who comprised of 36 freshmen as well as 48 graduate students. Data used in the study was gathered using questionnaires and interview schedule. The study data was analysed using descriptive statistics, inferential statistics and content analysis. Findings revealed that Learner characteristics enhance academic achievement. A contextual gap exists as the study was not conducted in Nandi East Sub County.

2.6 Learning Environment and Learners' Academic Achievements

A study done by Adesoji and Olatunbosun (2022) as cited by Cherop (2023) in Nigeria revealed that the locality of the school, adequate practical sessions,

teachers' perception towards Chemistry teaching and teacher's attendance have significant contribution towards greater academic achievements in Chemistry. Factors such as learner enrolment, number of subjects, subject combination workload, number of streams and teacher involvement in administrative work affect the teacher-student ratio. Better learning environment with adequate resources have been proved to have a positive effect on academic achievement among Kenyan Primary schools' learners.

It is evident that an instructor's contribution to their learners' mean grade in Chemistry. When student perceive that their teachers have a high expectation on their academic achievement, they tend to be motivated to perform better in the subject therefore these learners will work extra hard to march their teachers' expectations. A study done in Alliance National secondary schools showed the magnitude in which learning environment affects individual score of learners in a Kenyan context (Gitogo 2018). A supportive and enabling learning environment which exhibit a wide range of practical work in Chemistry subject enhance high academic achievement in Chemistry.

Mukra, Silitonga and Restuati (2020), opined that a laboratory using adequate relevant resources enhances learners' practical skills and consequently improving learner's mean grade in Chemistry. Khaombi (2021), observed that low academic achievement in Chemistry among learners was due to limited exposure of learners to experimental work. Through a lot of practical work in Chemistry, the learners acquire skills on observation, recording, interpreting,

analysing and inferring the reactions that occur. This practical approach method of teaching makes learners to be more conversant with the experiments, prepares them for their KCSE examination and consequently high academic achievement in Chemistry. Mwangi (2020) confirms that Chemistry practicals have been an efficient way of increasing quality grades of learners in secondary schools. He argues that the type and frequency of Chemistry practical in teaching and learning of chemistry boost learners' academic achievement in Chemistry.

It is therefore important to expose learners to a lot of assessment and giving them feedback as a way of providing a conducive learning environment for achieving better mean grades in Chemistry in KCSE. In Chemistry curriculum, learners can be assessed and evaluated through processes such as observing them doing a practical work, questioning them, listening to their discussion, and setting assessment for marking such as Continuous Assessment Tests (CATs) and end of the exams and national summative evaluation such as KCSE. Twoli (2023) held that through frequent administration of CATs, the teacher will be able to determine whether the objectives of the topic have been achieved. This study will establish how frequency of practical work, class size, and teacher-student ratio influence the learner's academic achievement in Chemistry.

Usman, and Madudili (2019) studied the effect of learning environment on students' academic performance in Nigeria. The study used descriptive

research design and targeted 341 students and ended sampling 110 students randomly. Data used was gathered by use of questionnaires which was analyzed descriptively and inferentially. Findings revealed that learning environment enhances students' academic achievement. A contextual gap exists as the study was conducted in a different geographical setting. The study had not provided justification for the research design adopted and therefore a methodological gap exists which the current study sought to address.

2.7 Theoretical Framework

Hull's Reinforcement theory by Hull (Siddiqui, 2011) guided this study. According to Hull, the need would produce behaviour and the particular behaviour that minimises the need would be learned gradually. Therefore, a reward or reinforcement is important in order to trigger the behaviour. Curricularists view globally indicates that learning, as a drive, can be demonstrated through behaviour hence the significance of student's behaviour in the teaching and learning processes as reinforcement for that behaviour, strengthening the connection between the drive and behaviour. Therefore, the need to gain knowledge and competences enable learners to strife for quality grades in the KCSE Chemistry results. This consequently leads them to explore and to discover new concepts and knowledge.

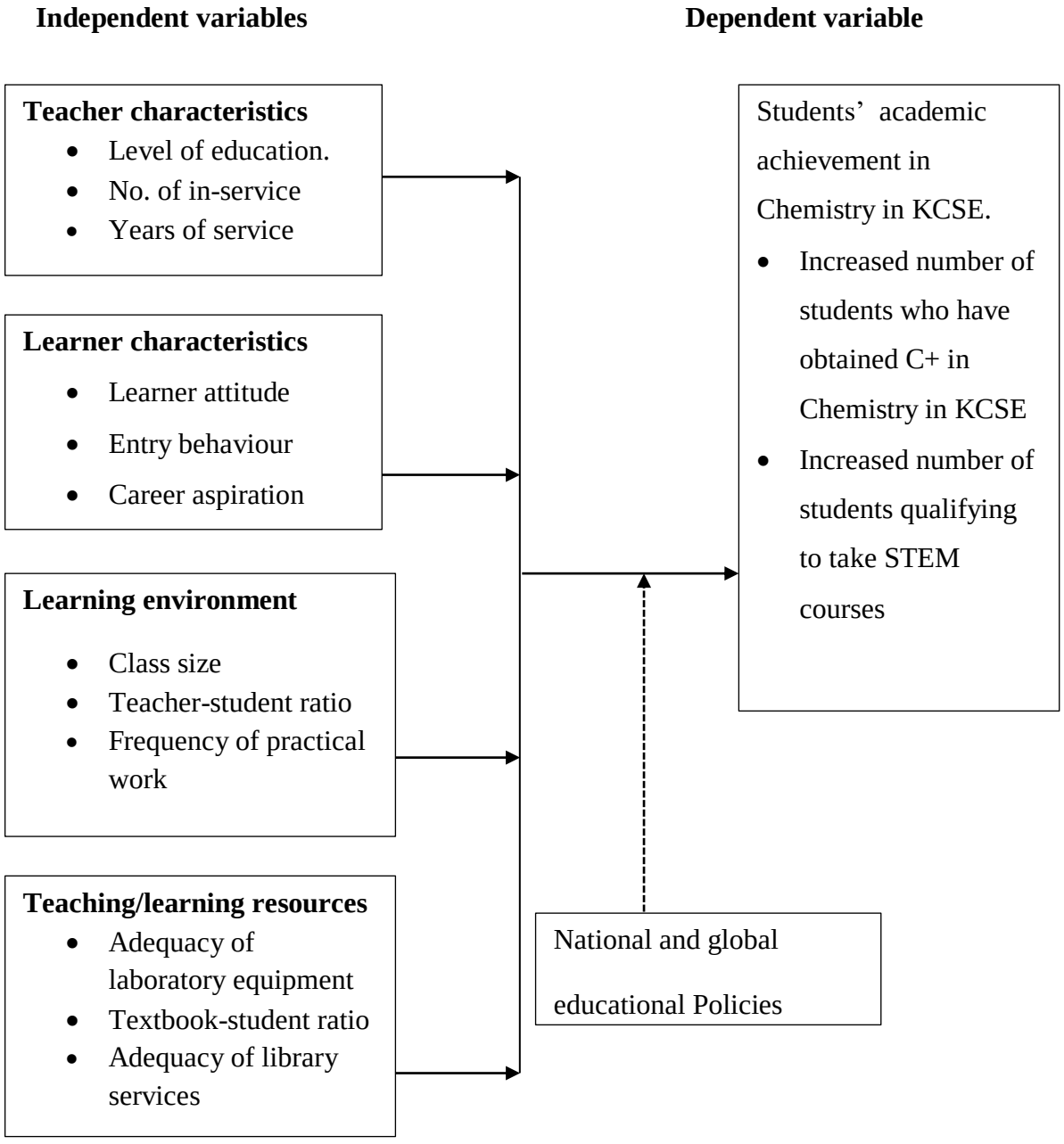
Reinforcement of learners' academic achievement involves variables such as learning environment and learner factors. These entail the provision of

adequate teaching and learning resources such as well-equipped laboratories and library, and availability of enough chemistry teachers. These positively influence learners' academic achievement. Reinforcement of the learning environment through interaction of learners with various practical sessions and assignment, spacious classrooms has a likelihood of enhancing learners' academic achievement. Learners' characteristics such as attitude and career aspiration may be a source of reinforcement to the learner in the process of knowledge acquisition. Additionally, reinforcing teacher characteristics through in-service training may have a positive influence on learner academic achievement.. In this regard, regular in-servicing of Chemistry teachers, and provision of adequate teaching and learning resources increases the chances of posting high learners' academic achievement. This theory related to this study since reinforcing the school learning environment, learner characteristics, teaching and learning resources and teacher characteristics may influence mean grade of the learners in Chemistry, which the study intended to investigate.

2.8 Conceptual Framework

Figure 2.1 below indicates the influence of independent variable on the dependent variable as shown by the arrows. The conceptual framework also showed the intervening variable where the study examined associations between the independent variable (teacher and learner characteristics, learning environment and teaching and learning resources) and the dependent variable (academic achievement).

Figure 2.1 Conceptual Framework



Independent variables adopted were teacher characteristics (level of education, number of in-service training attended and years of service), the learner characteristics (learner attitude, entry behaviour, and career aspiration), the learning environment (class size, teacher-student ratio and frequency of practicals) and the teaching and learning resources(which involves adequacy

of laboratory equipment, library services and student-textbook ratio). This figure 2.1 was used to show the kind of associations between the variables adopted in the study.

2.10 Summary of Reviewed Literature

Although studies have been conducted on school-based factors influencing learner academic achievement in a number of regions under different environments, this study provided an opportunity for generating new knowledge in Nandi East sub-county. Additionally, Kyalo (2020), Ogutu (2020) and Khaombi (2021) used survey design their study. However, this study used Ex-post facto research design to examine the factors influencing learners' academic achievement. From the reviewed literature, the study established the existence of knowledge-based gap as no other study has been conducted in Nandi East Sub County.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter consists of research methodology that was used to carry out the study. It is divided into introduction, research design of the study, target population, sampling procedure and sample size, and research instruments.

3.2 Research Design

The study was guided by ex post facto research design which attempts to determine the connection between an independent variable and dependent variable. The study examined how independent variable (factors) affects the dependent variable (the learners' academic achievement). Factors cannot be manipulated or altered; hence the choice of the ex post facto design looked at how a particular characteristics, trait or past occurrence affects the dependent variable the learner academic achievement. This design was suitable for the study in finding causal relationships between events and circumstances that a learner is exposed to and that affects the academic achievement of the learner as measured in KCSE Chemistry mean grade. Ex post facto research investigates events that have already occurred (past learners' academic achievement in Chemistry in KCSE) without adjusting the variables.

3.3 Target Population

The Nandi East Sub County contains 20 public day schools; therefore, this study targeted 20 public day secondary schools consisting of 20 principals and 20 Chemistry teachers. Form four learners were targeted too, a total of 1160 learners in the 20 public day secondary schools, because they had learnt most

of the content in Chemistry curriculum and experience the different factors which influence their academic performance. Hence the total target population was 1200 respondents.

3.4 Sample Size and Sampling Procedures

Sampling involves the selection and analysis of part of the population. A sample size of 291 selected from 18 public day secondary schools in the 20 public day schools in Nandi East Sub County was used. A total of 255 learners were selected using proportionate sampling technique. The principal and one Chemistry teacher were purposively selected in the sampled schools due to their roles as Chemistry teacher and administrative role respectively. This was achieved using Krejcie & Morgan Sample Determination Table for sampling the respondents, while Yamane formula below in sampling schools.

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

$$= \frac{20}{(1+20(0.08)^2)}$$

$$n=18$$

Where;

n= sample size

N= Population size

e=level of precision of sampling error which is 0.08%

3.5 Research Instruments

Questionnaires, interview schedule and document analysis were the main tools for collecting data in this study. Learner questionnaires were structured into two parts. Part one involved items on learner background information, while part two highlighted items on; learner characteristics, learning environment, availability of teaching and learning resources and teacher characteristics. A chemistry teacher questionnaire was structured into two parts. Part one was used to collect data on teacher demographics and part two on variables such as learners' characteristics, learning environment, teacher characteristics, and availability of teaching and learning resources. A 5-point Likert scale was adopted and it was of the form '1' represented strongly disagree while 5 represented strongly agree. Moreover, an interview schedule based on the four objectives and other probing questions was used to collect data from the selected school principal. KCSE results document analysis template was used to collect learners' KCSE grades in Chemistry for the past five years.

3.6 Validity of Research Instruments

Content validity was used which was tested using experts' opinion. The supervisors' opinions were used to improve on the contents of the research instruments. For validity of the research instruments to be tested, a pilot study was conducted in the neighbouring Nandi Central Sub County. The feedback from the respondents was used to improve on the accuracy status for the questionnaire's items. The supervisor confirmed that the instruments used captured the information required. The essence of this validity was to confirm instruments accuracy (Best & Kahn, 2019).

3.7 Reliability of Research Instruments

In every research, determination of instrument reliability reflects the strength or weakness of the research. Instruments reliability was tested by split-half technique of the item in a pilot study and then determining where there are no variations in the responses given (Wanjala, 2021). If the reliability is between -1 and 1, then there is a high correlation and, in this regard, the instrument is reliable for use. As shown in Table 3.1, the composite Cronbach alpha was .743 for the learner's questionnaire and 0.749 for the teacher's questionnaire which implied that the questionnaires were reliable. Therefore, the questionnaire items were able to collect the intended data.

Table 3.3: Reliability Analysis of Each Variable

Item	No. of Items	Cronbach's alpha
Learners Questionnaire		
Teacher characteristics	8	.709
Teaching and learning resources	10	.717
Learner characteristics	6	.701
Learning environment	6	.833
Academic achievement	5	.753
Composite value	**35**	**.743**
Teachers Questionnaire		
Teacher characteristics	8	.711
Teaching and learning resources	10	.787
Learner characteristics	6	.703
Learning environment	6	.795
Composite value	**30**	**.749**

3.8 Data Collection Procedure

After clearance from the Department of Education in the university, a research permit was obtained from National Commission for Science, Technology and Innovations (NACOSTI). Upon granting permission, clearance from the Sub County office was sought prior to visiting the sampled secondary schools. The researcher administered the questionnaires, undertake the interview and fill the KCSE results document analysis template, in each of the public day secondary schools sampled.

3.9 Data Analysis Techniques

Data from questionnaires which is quantitative was analysed using both descriptive statistics and inferential statistics. The former included frequencies, percentages, mean and standard deviation. The latter adopted multiple regression analysis. The Statistical Package for Social and Science (SPSS) was used to arrange data. Likert Scale Scores were as follows; SD (1), D (2), Neutral (3), A (4), SA (5). The range of interpreting the Likert scale mean score was given as follows: 1.0-2.4 (Negative attitude), 2.5-3.4 (Neutral attitude), and 3.5-5.0 (Positive attitude). The hypotheses were tested using inferential statistics, that is, multiple regression at 5% level of significance. The hypotheses were rejected when the p-value was less than 5% and if the p - value was above 0.05 the hypotheses were accepted.

The regression model that was adopted in the study was as follows:

$$Y= \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \boldsymbol{\varepsilon}$$

Where;

Y is the dependent variable (learners' academic achievement).

α represents the intercept (regression constant).

β_1 represents the change in y for each increment change in X_1

β_2 represents change in y for each increment change in X_2

β_3 represents change in y for each increment change in X_3

β_4 represents change in y for each increment change in X_4

X_1represents teacher characteristics

X_2represents adequacy of teaching and learning resources

X_3represents learner characteristics

X_4represents learning environment

ε represents the error term

Interview data was analyzed using common themes. Data from secondary sources was analyzed descriptively where it was summarized using trendlines. Data for the study was presented using frequency tables.

3.10 Ethical Consideration

The study was conducted in line with research ethical standards and principles which include acquisition of a permit from NACOSTI to undertake research among the targeted population. Additionally, a clearance and authorisation from the Department of Education in the County of Nandi was sought. The consent of the respondent was upheld by informing them the purpose of the research, writing their personal names was not a requirement and the respondents were assured that the information that they will provide was upheld confidential.

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter covers data analysis results, interpretation and discussion. The other items covered in this chapter include response rate, demographic information of the respondents, descriptive statistics findings on teacher characteristics, teaching and learning resources, learner characteristics and learning environment as well as discussions on the study variables. The results on correlation and regression analysis are also provided in this chapter. Qualitative results collected via the interview guide are also provided in narrative form. Findings are presented in the order in which the specific objectives appear in this project.

4.2 Response Rate

The study used two sets of questionnaires, one for the learners and the other one for teachers. In regards to the one for the learners, a total of 255 questionnaires were issued, out of which 241 questionnaires were returned. However, 34 questionnaires were not completely filled implying that only 207 questionnaires were completely filled. This represented a response rate of 81.2% as shown in Table 4.1. In relation to teachers, 18 questionnaires were issued to respondents and 16 questionnaires returned. Only 1 questionnaire was incomplete and therefore 15 questionnaires were completely filled. This represented a response rate of 83.3% as shown in Table 4.1 as well.

Table 4.4: : Response Rate

	Questionnaires issued	Questionnaires returned	Incomplete questionnaires	Complete questionnaire	Response rate
Learners	255	241	34	207	81.2%
Teachers	18	16	1	15	83.3%

The response rate for both learners and teachers were high and this was attributed to the method of questionnaire distribution to the respondents. The questionnaires were self-administered to the respondents and the respondents were allowed between 7 to 10 minutes to fill the questionnaires and therefore it contributed to high questionnaire response rate. This implies that the findings could be generalised to the whole Nandi East Sub County.

4.3 Demographic Information of the Respondents

For the learners, demographic information of the respondents (Learners) was in-terms of gender, age, grade scored in science in KCPE, and average number of students in present class. While the Teachers bio data requested was on gender, highest academic qualification, employer, years the teachers had been teaching, the number of Chemistry teachers in the school, the number of in-service trainings attended by the teacher and interaction styles used while teaching Chemistry. Findings on the demographic information of the Learners were presented in Table 4.2.

Table 4.5: Demographic Characteristics of Learners

n=207		Frequency	Percent
Gender of Learners	Male	98	47.0
	Female	109	53.0
Age of Learners	15-17	66	31.9
	18-21	94	45.4
	Any other	47	22.7
Grade scored in science in KCPE	A	25	12.1
	B	90	43.5
	C	59	28.5
	D	33	15.9
Average number of Students in Class	0-10	16	7.7
	11-20	26	12.6
	21-30	87	42.0
	31-39	42	20.3
	41-44	23	11.1
	Above 45	13	6.3

Findings revealed that majority of respondents 109 (53.0%) were female while 98 (47.0%) male. This implies that most of the learners who participated in the

study were female. The findings revealed that majority of the learners age category, 94 (45.4%) was between 18 and 21 years, 66 (31.9%) between 15 to 17 years and 47 (22.7%) were aged slightly above 21 years. Therefore, most of the learners were mature, hence positively influenced learner's ability to understand the concepts taught in Chemistry lessons. Out of the total respondents, 25 (12.1%) scored an A in science, 90 (43.5%) B, 59 (28.5%) C and 33 (15.9%) scored a D. This implies that majority of the respondents score in science at KCPE level was B which positively influence learner academic achievement in Chemistry in KCSE. The study results also revealed that 16 (7.7%) average number of students in present class was between 0 to 10, 26 (12.6%) between 11 to 20 learners, 87 (42.0%) between 21 to 30 years, 42 (20.3%) 31 to 39 years, 23(11.1%) 41 to 44 learners and 13 (6.3%) above 45 learners. This implies that the majority of the average number of students present in class was 21 to 30 students. Hence spacious classrooms favourably influenced learners' academic achievement.

The demographic information of the Teachers was presented in Table 4.3. The study also sought to find-out the distribution of teachers by gender. Findings were presented in Table 4.3

Table 4.6: Demographic information of the Teachers

n=15		Frequency	Percent
Gender of Teachers	Male	4	27/0
	Female	11	73.0
Highest Academic Qualification	Doctorate	0	0.0
	Masters' degree	2	13.4
	BED	10	66.7
	Diploma	1	6.7
	Teacher trainees	2	13.3
	Untrained teachers	0	0.0
Years Taught	Less than a year	2	13.3
	1-5 years	3	20.0
	6-10 years	5	33.3
	11-15 years	3	20.0
	16-20 years	1	6.7
	Above 20 years	1	6.7
Number of Chemistry Teachers in the School	<3	3	20.0
	3-5	7	47.0
	>5	5	33.0
Number of in-service trainings	<5	9	40.0
	>5	6	60.0
Interaction styles	Lecture method	3	20.0
	Practical approach	7	46.7
	Demonstration method	5	33.3

Out of the 15 teachers who participated in the study, 11 (73.0%) were male while 4 (27.0%) female. The respondents (Teachers) were drawn from different genders which helped to improve the quality of the opinions that were provided in the study. The study also sought to determine the highest academic qualification had been operationalized using Doctorate, Master's degree, BED, Diploma, teacher trainees and untrained teachers. None of the teachers had a doctorate degree, 2 (13.4%) had a master's degree, 10 (66.7%) BED, 1 (6.7%) diploma, 2 (13.3%) teacher trainees and 0 (0.0%) untrained teachers. This implies that majority of the teachers had a bachelors' degree in education; well trained teachers have the capabilities and skills needed during teaching and learning, consequently influencing positively learners' academic achievement. The study sought to determine the years taught by the respondents. It is evident from the study findings that majority of the respondents 5 (33.3%) had taught between 6 to 10 years, 3 (20.0%) between 1 to 5 years, 3 (20.0%) between 11 to 15 years, 2 (13.3%) less than a year, 1 (6.7%) between 16 to 20 years and 1 (6.7%) above 20 years. Years taught differed across the respondents and therefore it enhanced diversity in the opinions provided in the study which helped to improve the quality of the findings provided in the study. Therefore there is a positive implication of years taught on learners' academic achievement. The study also sought to determine the number of chemistry teachers in the school. The study established that the majority number of chemistry teachers were between 3 to 5 which is represented 47.0%, 3 (20.0%) revealed that they were less than 3 teachers and 5 (33.0%) more than 5 teachers. The number of Chemistry

Teachers in the Schools differed in the study and this had diverse impact on students' academic achievement. Teacher-student ratio was adequate, hence positively influencing learners'' academic achievement.

The study established that 9 (60.0%) of the respondents' in-service trainings were less than 5 while 6 (40.0%) more than 5. This implies that the respondents' number of in-service trainings differed in the study which brought in diversity in the opinions on the effect of number of in-service trainings on students' academic achievement. In-service training endows the teacher with teaching skills and competencies relevant to classroom instruction processes, consequently improving learners' academic achievement. The study also sought to determine the interaction styles teachers used while teaching chemistry. The study established that majority of the respondents, 7 (46.7%) used practical approach, 5 (33.3%) demonstration method and 3 (20.0%) lecture method. Practical approach positively influences learners' academic achievement since it exposes prepares the learners to sit for their final KCSE Chemistry exams.

4.4 Teacher Characteristics and Learners' Academic Achievement in Chemistry

On the first objective, the researcher collected data on teacher characteristics from learners and teachers. Findings were presented in Table 4.4 and Table 4.5.

Table 4.7: Learner's Responses on Teacher Characteristics

n=207		SA	A	NS	D	S. D	Mean	Std. Dev
1. The level of education of a Chemistry teacher has a favourable influence on our academic achievement in Chemistry in KCSE.	F	119	42	16	17	13	1.8551	1.23786
	%	57.5	20.3	7.7	8.2	6.3		
2. The level of education of a Chemistry teacher does not have a favourable influence on our academic achievement in Chemistry in KCSE.	F	0	0	16	148	43	4.1304	.51895
	%	0.0	0.0	7.7	71.5	20.8		
3. Our Chemistry teachers regularly attend in service training to improve their skills in teaching.	F	47	76	22	45	17	2.5604	1.27902
	%	22.7	36.7	10.6	21.7	8.2		
4. Our Chemistry teachers rarely attend in service training to improve their skills in teaching.	F	28	16	98	36	29	3.1063	1.16098
	%	13.5	7.7	47.3	17.4	14.0		
5. Chemistry teachers with longer years of service contribute favourably to high learners' academic achievement in Chemistry in KCSE.	F	39	122	16	17	13	2.2415	1.05187
	%	18.8	58.9	7.7	8.2	6.3		
6. The years of service of a Chemistry teacher does not favourably contribute to high learners' academic achievement in Chemistry.	F	13	33	25	87	49	3.6087	1.18916
	%	6.3	15.9	12.1	42.0	23.7		
7. Teachers who regularly attend in-service favourably influence learners' academic achievement.	F	53	99	16	26	13	2.2609	1.15732
	%	25.6	47.8	7.7	12.6	6.3		
8. Teachers who do not attend in-service regularly influence learners' academic achievement.	F	13	17	16	91	70	3.9082	1.14327
	%	6.3	8.2	7.7	44.0	33.8		

On whether the level of education of a Chemistry teacher has a favourable influence on academic achievement in Chemistry in KCSE. As per Table 4.4, findings revealed that 119 (57.5%) strongly agreed, 42 (20.3%) agreed, 17 (7.7%) were not sure, 17 (8.2%) disagreed while 13 (6.3%) strongly disagreed. The level of education of a Chemistry teacher was further established to positively influence the academic achievement in Chemistry in KCSE with (Mean=1.8551, std. Dev=1.23786). Findings are similar to that of Junejo et al. (2021) that the level of education of a Chemistry teacher has a favourable influence on our academic achievement in Chemistry in KCSE.

Regarding the level of education of a Chemistry teacher does not have a favourable influence on our academic achievement in Chemistry in KCSE, 16 (7.7%) were not sure, 148 (71.5%) disagreed while 43 (20.8%) strongly disagreed. The item further recorded a mean of 4.1304 and a variation in responses of 0.51895. This implies that the level of education of a Chemistry teacher has a positive influence on academic achievement in Chemistry in KCSE. The findings disagree with that of Muse, et al. (2019) that the level of education of a Chemistry teacher does not have a favourable influence on learners' academic achievement.

Out of the total respondents, 47 (22.7%) strongly agreed that their Chemistry teachers regularly attended in service training to improve their skills in teaching, 76 (36.7%) agreed, 22 (10.6%) were not sure, 45 (21.7%) disagreed while 17 (8.2%) strongly disagreed. The study further established that attending regularly in service training by Chemistry teachers improves their

skills in teaching with (mean=2.5604, std. deviation =1.27902). Ojukwu (2022) also established that chemistry teachers' regular attendance of in service training improves their skills in teaching.

In relation to whether Chemistry teachers rarely attend in service training to improve their skills in teaching, 28 (13.5%) strongly agreed, 16 (7.7%) agreed, 98 (47.3) were not sure, 36 (17.4%) disagreed while 29 (14.0%) strongly disagreed. Majority of the respondents revealed that chemistry teachers attend in service trainings to improve their skills in teaching with (mean = 3.1063, std. dev=1.16098). Findings are not in agreement with that of Copriady et al. (2021) that Chemistry teacher rarely attends in service training to improve their skills in teaching.

In regards to whether chemistry teachers with longer years of service contribute favourably to high learners' academic achievement in Chemistry in KCSE, 39 (18.8%) strongly agreed, 122 (58.9%) agreed, 16 (7.7%) were not sure, 17 (8.2%) disagreed while 13 (6.3%) strongly disagreed. The study further established that chemistry teachers with longer years of service contribute positively to high learners' academic achievement in Chemistry in KCSE with (mean= 2.2415, std. Dev. = 1.05187). The study agrees with that of Junejo et al. (2021) that chemistry teachers with longer years of service contribute favourably to high learners' academic achievement.

On whether the years of service of a Chemistry teacher does not favourably contribute to high learners' academic achievement in Chemistry, 13 (6.3%)

strongly agreed, 33 (15.9%) agreed, 25 (12.1%) were not sure, 87 (42.0%) disagreed while 49 (23.7%) strongly disagreed. The study further established that years of service of a Chemistry teacher favourably contribute to high learners' academic achievement in Chemistry with (mean= 3.6087, std. Dev. = 1.18916). The study agrees with Ugwe (2023) that the years of service of a Chemistry teacher favourably contribute to high learners' academic achievement in Chemistry.

The study was also interested in determining whether teachers who regularly attend in-service favourably influence learners' academic achievement, 53 (25.6%) strongly agreed, 99 (47.8%) agreed, 16 (7.7%) were not sure, 26 (12.6%) disagreed while 13 (6.3%) strongly disagreed. Teachers who regularly attend in-service favourably was further established to influence learners' academic achievement with (mean= 2.2609, std. Dev. = 1.15732). Adiele (2021) also established that teachers who regularly attend in-service favourably influence learners' academic achievement. On whether teachers who do not attend in-service regularly influence learners' academic achievement, 13 (6.3%) strongly agreed, 17 (8.2%) agreed, 16 (7.7%) not sure, 91 (44.0) disagreed while 70 (33.8%) strongly disagreed. Teachers who do not attend in-service regularly was further established to affect learners' academic achievement with (mean= 3.9082, std. Dev. = 1.14327). Muse et al. (2019) also held the opinion that teachers who do not attend in-service regularly negatively influence learners' academic achievement. The findings on the teachers who were issued with questionnaires were as shown in Table 4.5.

Table 4.8: Teacher's Responses on Teacher Characteristics

n=15		SA	A	NS	D	SD	Mean	Std. Dev
7. The level of education of a Chemistry teacher favourably influences leaners' academic achievement in Chemistry in KCSE.	F	9	3	1	1	1	1.8000	1.26491
	%	60.0	20.0	6.7	6.7	6.7		
8. The level of education of a Chemistry teacher negatively influences leaners' academic achievement in Chemistry in KCSE.	F	1	1	2	5	6	3.9333	1.22280
	%	6.7	6.7	13.3	33.3	40.0		
9. Chemistry teachers in my school regularly attend in-service training to improve their skills in teaching.	F	3	6	1	3	2	2.6667	1.39728
	%	20.0	40.0	6.7	20.0	13.3		
10. Chemistry teachers in my school rarely attend in-service training to improve their skills in teaching.	F	1	1	2	5	6	3.9333	1.22280
	%	6.7	6.7	13.1	33.3	40.0		
11. Longer years of experience in teaching Chemistry contribute favourably to high learners' academic achievement in Chemistry.	F	8	4	1	1	1	1.8667	1.24595
	%	53.3	26.7	6.7	6.7	6.7		
12. Few years of teaching Chemistry negatively influence learners' academic achievement in Chemistry in KCSE.	F	10	2	1	1	1	1.7333	1.27988
	%	66.7	13.3	6.7	6.7	6.7		
13. Teachers who regularly attend in-service (1-2 times a year) favourably influence learners' academic achievement.	F	6	6	1	1	1	2.0000	1.19523
	%	40.0	40.0	6.7	6.7	6.7		
14. Teachers who do not attend in-service regularly negatively influence learners' academic achievement.	F	5	6	1	1	2	2.2667	1.38701
	%	33.3	40.0	6.7	6.7	13.3		

On whether the level of education of a Chemistry teacher favourably influences leaner's academic achievement in Chemistry in KCSE, 9 of the 15 teachers strongly agreed while 3 agreed. This represented 60.0% and 20.0% respectively. One (1) was not sure, 1 disagreed while 1 strongly disagreed. This was represented by 6.7%, 6.7% and 6.7% respectively. It was established further that the level of education of a Chemistry teacher positively affects learners' academic achievement in Chemistry in KCSE with (mean= 1.8000, std. Dev. = 1.26491). Findings are similar to that of Junejo, et al. (2017) that the level of education of a Chemistry teacher favourably influences learners' academic achievement.

As to whether the level of education of a Chemistry teacher negatively influences learners' academic achievement in Chemistry in KCSE, 1 (6.7%) strongly agreed, 1 (6.7%) agreed, 2 (13.3%) were not sure, 5 (33.3%) disagreed while 6 (40.0%) strongly disagreed. It was established further that the level of education of a Chemistry teacher does not negatively influence learners' academic achievement in Chemistry in KCSE with (mean= 3.9333, std. Dev. = 1.22280). The study results are in agreement with that of Ojukwu (2022) that the level of education of a Chemistry teacher does not negatively influence learners' academic achievement.

In regards to whether chemistry teachers in the school regularly attend in-service training to improve their skills in teaching, 3 (20.0%) strongly agreed, 6 (40.0%) agreed, 1 (6.7%) were not sure, 3 (20.0%) disagreed while 2

(13.3%) strongly disagreed. Attending in-service training by Chemistry teachers in the school regularly was further established to affect learners' academic achievement in Chemistry in KCSE with (mean= 2.6667, std. Dev. = 1.39728). Findings are in tandem with that of Copriady et al. (2021) that Chemistry teachers in the school regularly attend in-service training to improve their skills in teaching.

The study also sought to determine whether Chemistry teachers in the school rarely attend in-service training to improve their skills in teaching, 1 (6.7%) strongly agreed, 1 (6.7%) agreed, 2 (13.1%) not sure, 5 (33.3%) disagreed and 6 (40.0%) strongly disagreed. It was established further that rarely attending in-service training by Chemistry teachers in the school affects learners' academic achievement with (mean= 3.9333, std. Dev. = 1.22280). Findings are in tandem with that of Ugwe (2023) that rarely attending in-service training by Chemistry teachers in the school affects learners' academic achievement.

In relation to whether longer years of experience in teaching Chemistry contribute favourably to high learners' academic achievement in Chemistry, 8 (53.3%) strongly agreed, 4 (26.7%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 1 (6.7%) strongly disagreed. Longer years of experience in teaching Chemistry was further established to affect learners' academic achievement in Chemistry with (mean= 1.8667, std. Dev. = 1.24595). Findings agrees with that of Muse et all (2019) that longer years of experience in teaching Chemistry affects learners' academic achievement in Chemistry.

On whether few years of teaching Chemistry negatively influence learners' academic achievement in Chemistry in KCSE, 10 (66.7%) strongly agreed, 2 (13.3%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 1 (6.7%) strongly disagreed. Few years of teaching Chemistry was further established to influence learners' academic achievement in Chemistry in KCSE with (mean= 1.7333, std. Dev. = 1.27988). Findings are similar to that of Muse et al. (2019) that few years of teaching Chemistry affects learners' academic achievement.

In relation to whether teachers who regularly attend in-service (1-2 times a year) favourably influence learners' academic achievement, 6 (40.0%) strongly agreed, 6 (40.0%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 1 (6.7%) strongly disagreed. Teachers regularly attending in-service (1-2 times a year) was further established to influence learners' academic achievement with (mean= 2.0000, std. Dev. = 1.19523). The study agrees with that of Junejo et al. (2021) that Teachers regularly attending in-service (1-2 times a year) affects learners' academic achievement positively.

Additionally, the study sought to determine whether teachers who do not attend in-service regularly negatively influence learners' academic achievement, 5 (33.3%) strongly agreed, 6 (40.0%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 3 (13.3%) strongly disagreed. It was further established that teachers who do not attend in-service regularly affects learners' academic achievement with (mean= 2.2667, std. Dev. = 1.38701).

The study is in agreement with that of Copriady et al. (2021) that teachers who do not attend in-service regularly affects learners' academic achievement. One of the respondents interviewed revealed that:

> *"Chemistry teachers in the school regularly attended in-service training to improve their skills in teaching. The longer years of experience in teaching Chemistry, contributes to high learners' academic achievement in Chemistry."*

4.5 Teaching and Learning Resources and Learners' Academic Achievement in Chemistry

On 2nd objective, two sets of questionnaires were used to determine collect various responses on the subject matter from both learners and teachers. Findings were presented in Table 4.6 and Table 4.7 respectively.

The study sought to determine whether the chemistry laboratory is adequate for use by all learners, 14 6.8%) strongly agreed, 16 (7.7%) agreed, 16 (7.7%) were not sure, 67 (32.4%) disagreed while 94 (45.4%) strongly disagreed. It was further established that adequacy of the chemistry laboratory positively influence learners' academic achievement in Chemistry with (mean= 4.0193, std. Dev. = 1. 20662). Findings are in tandem with that of Isiola (2015) that adequacy of the Chemistry laboratory affected learners' academic achievement. On whether the school does not have a Chemistry laboratory and this negatively influence learners' academic achievement in KCSE, 16 (7.7%) were not sure, 52 (25.1%) disagreed while 139 (67.1%) strongly disagreed.

Table 4.9: Learner's Responses on Teaching & Learning Resources

n=207		SA	A	NS	D	SD	Mean	Std. Dev
13. Our Chemistry laboratory is adequate for use by all learners.	F	14	16	16	67	94	4.0193	1.20662
	%	6.8	7.7	7.7	32.4	45.4		
14. Our school does not have a Chemistry laboratory and this negatively influence learners' academic achievement in KCSE.	F	0	0	16	52	139	4.5942	.63058
	%	0.0	0.0	7.7	25.1	67.1		
15. Adequate library services contribute to high academic achievement among learners	F	118	46	16	14	13	3.8164	1.06357
	%	57.0	22.2	7.7	6.8	6.3		
16. Inadequate library services contribute to low academic achievement among learners.	F	97	62	17	17	14	1.9807	1.22261
	%	46.9	30.0	8.2	8.2	6.8		
17. Adequate laboratory apparatus and chemicals positively influence learners' academic achievement in Chemistry in KCSE.	F	116	37	25	13	16	1.9179	1.27638
	%	56.0	17.9	12.1	6.3	7.7		
18. Inadequate laboratory apparatus and chemicals negatively influence learners' academic achievement in Chemistry in KCSE.	F	55	97	25	17	13	2.2077	1.11492
	%	26.6	46.9	12.1	8.2	6.3		
19. Adequate Chemistry course books at 1:1 ratio contributes to high learner academic achievement.	F	127	49	13	9	9	1.6667	1.06580
	%	61.4	23.7	6.3	4.3	4.3		
20. Inadequate Chemistry course books (at 1:2 or more) in our school contribute to low learner academic achievement.	F	109	53	16	16	13	1.8937	1.21412
	%	52.7	25.6	7.7	7.7	6.3		
21. Our Chemistry teacher always uses charts, models and other teaching aids during Chemistry lessons which positively influence learners' academic achievement.	F	130	27	16	17	17	1.8599	1.32734
	%	62.8	13.0	7.7	8.2	8.2		
22. Our Chemistry teachers rarely uses charts, models and other teaching aids during Chemistry lessons and hence negatively influence learners' academic achievement.	F	13	17	16	64	97	4.0386	1.20212
	%	6.3	8.2	7.7	30.9	46.9		

It was further established that not having a Chemistry laboratory negatively affects learners' academic achievement in KCSE with (mean= 4.5942, std. Dev. = .63058). The study agrees with that of Takwate (2018) that not having a Chemistry laboratory negatively affects learners' academic achievement.

With regard to whether adequate library services contribute to high academic achievement among learners, 118 (57.0%) strongly agreed, 46 (22.2%) agreed, 16 (7.7%) not sure, 14 (6.8%) disagreed while 13 (6.3%) strongly disagreed. Adequacy of library services was further established to affect learners' academic achievement with (mean= 3.8164, std. Dev. = 1.06357). Findings are similar to that of Ahmed, et al. (2021) that adequacy of library services positively affects learners' academic achievement.

Out of the total respondents, 97 (46.9%) strongly agreed that inadequate library services contribute to low academic achievement among learners, 62 (30.0%) agreed, 17 (8.2%) not sure, 17 (8.2%) disagreed while 14 (6.8%) strongly disagreed. Inadequate library services were further established to affect learners' academic achievement with (mean= 1.9807, std. Dev. = 1.22261). Yusuf (2022) also established that inadequate library services negatively affect learners' academic achievement. In regards to whether adequate laboratory apparatus and chemicals positively influence learners' academic achievement in Chemistry in KCSE, 116 (56.0%) strongly agreed, 37 (17.9%) agreed, 25 (12.1%) were not sure, 13 (6.3%) disagreed while 16 (7.7%) strongly disagreed. Adequacy of laboratory apparatus and chemicals was further established to affect learners' academic achievement with (mean=

1.9179, std. Dev. = 1.27638). Findings agree with that of Bittok (2019) that adequacy of laboratory apparatus and chemicals influences learners' academic achievement.

In relation to whether inadequate laboratory apparatus and chemicals negatively influence learners' academic achievement in Chemistry in KCSE, 55 (26.6%) strongly agreed, 97 (46.9%) agreed, 25 (12.1%) not sure, 17 (8.2%) disagreed while 13 (6.3%) strongly disagreed. Inadequate laboratory apparatus and chemicals was further established to affect learners' academic achievement with (mean= 2.2077, std. Dev. = 1.11492). The study results are in tandem with that of Njagi and Silas (2021) that inadequate laboratory apparatus and chemicals affects learners' academic achievement.

As to whether adequate Chemistry course books at 1:1 ratio contributes to high learner academic achievement, 127 (61.4%) strongly agreed, 49 (23.7%) agreed, 13 (6.3%) not sure, 9 (4.3%) disagreed while 9 (4.3%) strongly disagreed. Adequate Chemistry course books at 1:1 ratio was further established to affect learners' academic achievement with (mean= 1.6667, std. Dev. = 1.06580). The study is in agreement with that of Yusuf (2022) that adequate Chemistry course books affects learners' academic achievement. On whether inadequate Chemistry course books (at 1:2 or more) in the school contributes to low learner academic achievement, 109 (52.7%) strongly agreed, 53 (25.6%) agreed, 16 (7.7%) not sure, 16 (7.7%) disagreed while 13 (6.3%0 strongly disagreed. Inadequate Chemistry course books (at 1:2 or

more) in the school was further established to affect learners' academic achievement with (mean= 1.8937, std. Dev. = 1.21412). Isiola (2021) also established that inadequate Chemistry course books in the school affects learners' academic achievement.

As to whether the chemistry teacher always uses charts, models and other teaching aids during Chemistry lessons which positively influence learners' academic achievement, 130 (62.8%) strongly agreed, 27 (13.0%) agreed, 16 (7.7%) not sure, 17 (8.2%) disagreed while 17 (8.2%) strongly disagreed. The use of charts, models and other teaching aids during Chemistry lessons by the Chemistry teacher was further established to affect learners' academic achievement with (mean= 1.8599, std. Dev. = 1.32734). Findings agrees with that of Takwate (2018) that use of charts, models and other teaching aids during Chemistry lessons by the Chemistry teacher affects learners' academic achievement.

On whether the Chemistry teacher rarely uses charts, models and other teaching aids during Chemistry lessons and hence negatively influence learners' academic achievement, 13 (6.3%) strongly agreed, 17 (8.2%) agreed, 16 (7.7%) not sure, 64 (30.9%) disagreed while 97 (46.9%) strongly disagreed. Rarely using charts, models and other teaching aids during Chemistry lessons was further found to affect learners' academic achievement with (mean= 4.0386, std. Dev. = 1.20212). Isiola (2021) also established that rarely using charts, models and other teaching aids during Chemistry lessons affects

learners' academic achievement Teachers' responses on teaching and learning resources was as shown in Table 4.7.

The study sought to determine whether the Chemistry laboratory was adequate for use by all learners, 3 (20.0%) of the teacher strongly agreed with the statement, 1 (6.7%) agreed, 1 (6.7%) not sure, 7 (46.7%) disagreed while 3 (20.0%) strongly disagreed. Adequacy of chemistry laboratory was further established to affect learners' academic achievement with (mean= 3.4000, std. Dev. = 1.45406). In regards to whether the school does not have a Chemistry laboratory and this negatively influence learners' academic achievement in KCSE, 3 (20.0%) strongly agreed, 3 (20.0%) agreed, 2 (13.3%) not sure, 3 (20.0%) disagreed while 4 (26.7%) strongly disagreed. Not having a Chemistry laboratory was further established to affect learners' academic achievement with (mean= 3.1333, std. Dev. = 1.55226). The study agrees with that of Yusuf (2022) that not having a Chemistry laboratory affects learners' academic achievement. In relation to whether adequate library services contribute to high academic achievement among learners, 10 (66.7%) strongly agreed, 2 (13.3%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 1 (6.7%) strongly disagreed. Adequacy of library services was further established to affect learners' academic achievement with (mean= 3.7333, std. Dev. = 1. 27988). Findings are in tandem with that of Takwate (2018) that adequacy of library services affects learners' academic achievement.

Table 4.10: Teacher's Responses on Teaching and Learning Resources

n=15		SA	A	NS	D	SD	Mean	Std. Dev
15. Our Chemistry laboratory is adequate for use by all learners.	F	3	1	1	7	3	3.4000	1.45406
	%	20.0	6.7	6.7	46.7	20.0		
16. Our school does not have a Chemistry laboratory and this negatively influence learners' academic achievement in KCSE.	F	3	3	2	3	4	3.1333	1.55226
	%	20.0	20.0	13.3	20.0	26.7		
17. Adequate library services contribute to high academic achievement among learners.	F	10	2	1	1	1	1.7333	1.27988
	%	66.7	13.3	6.7	6.7	6.7		
18. Inadequate library services contribute to low academic achievement among learners.	F	6	5	2	2	1	2.1333	1.30201
	%	40.0	33.3	6.7	13.3	6.7		
19. Adequate laboratory apparatus and chemicals positively influence learners' academic achievement in Chemistry in KCSE.	F	6	6	1	1	1	2.0000	1.19523
	%	40.0	40.0	6.7	6.7	6.7		
20. Inadequate laboratory apparatus and chemicals negatively influence learners' academic achievement in Chemistry in KCSE.	F	9	3	1	1	1	1.8000	1.26491
	%	60.0	20.0	6.7	6.7	6.7		
21. Adequate Chemistry course books at 1:1 ratio contributes to high learner academic achievement.	F	5	7	1	1	1	2.0667	1.16292
	%	33.3	46.7	6.7	6.7	6.7		
22. Inadequate Chemistry course books (at 1:2 or more) in our school contributes to low learner academic achievement.	F	7	3	2	2	1	2.1333	1.35576
	%	46.7	20.0	13.3	13.3	6.7		
23. I always use charts, models and other teaching aids during Chemistry lessons which positively influence learners' academic achievement.	F	5	6	1	2	1	2.2000	1.26491
	%	33.3	40.0	6.7	13.3	6.7		
24. I rarely use charts, models and other teaching aids during Chemistry lessons and this negatively influence learners' academic achievement.	F	1	1	2	6	5	3.8667	1.18723
	%	6.7	6.7	13.3	40.0	33.3		

From the findings, 6 (40.0%) strongly agreed that inadequate library services contribute to low academic achievement among learners, 5 (33.3%) agreed, 2 (6.7%) not sure, 2 (13.3%) disagreed while 1 (6.7%) strongly disagreed. Inadequate library services were further established to affect learners' academic achievement with (mean= 2.1333, std. Dev. = 1. 30201). Out of the total respondents, 6 (40.0%) strongly agreed that adequate laboratory apparatus and chemicals positively influence learners' academic achievement in Chemistry in KCSE, 6 (40.0%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 1 (6.7%) strongly disagreed. Adequacy of laboratory apparatus and chemicals was further established to affect learners' academic achievement with (mean= 2.0000, std. Dev. = 1.19523). Findings are similar to that of Bittok (2019) that adequacy of laboratory apparatus and chemicals affects learners' academic achievement. In regards to whether inadequate laboratory apparatus and chemicals negatively influence learners' academic achievement in Chemistry in KCSE, 9 (60.0%) strongly agreed, 3 (20.0%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 1 (6.7%) strongly disagreed. Inadequate laboratory apparatus and chemicals was further established to affect learners' academic achievement with (mean= 1.8000, std. Dev. = 2.26491). The study by Njagi and Silas (2021) also found-out that inadequate laboratory apparatus and chemicals affects learners' academic achievement.

In a bid to establish whether adequate chemistry course books at 1:1 ratio contributes to high learner academic achievement, 5 (33.3%) strongly agreed,

7 (46.7%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 1 (6.7%) strongly disagreed. Adequate chemistry course books at 1:1 ratio was further established to affect learners' academic achievement with (mean= 2.0667, std. Dev. = 1.16292).The study agrees with that of Ahmed et al. (2021) that adequate chemistry course books at 1:1 ratio affects learners' academic achievement In relation to w hether inadequate Chemistry course books (at 1:2 or more) in the school contributes to low learner academic achievement, 7 (46.7%) strongly agreed, 3 (20.0%) agreed, 3 (13.3%) not sure, 2 (13.3%) disagreed while 1 (6.7%) strongly disagreed. Inadequate Chemistry course books (at 1:2 or more) was further established to affect learners' academic achievement with (mean= 2.1333, std. Dev. = 1.35576). The study by Isiola (2021) also established that inadequate Chemistry course books affects learners' academic achievement.

The study established that 5 (33.3%) of the respondents strongly agreed that they always used charts, models and other teaching aids during Chemistry lessons which positively influenced learners' academic achievement, 6 (40.0%) agreed, 1 (6.7%) were not sure, 2 (13.3%) disagreed while 1 (6.7%) strongly disagreed. The use of charts, models and other teaching aids during Chemistry lessons was further established to affect learners' academic achievement with (mean= 2.2000, std. Dev. = 1.26491). Findings agrees with that of Bittok (2019) that the use of charts, models and other teaching aids during Chemistry lessons affects learners' academic achievement.

Regarding whether the respondents rarely used charts, models and other teaching aids during Chemistry lessons and this negatively influence learners'

academic achievement, 1 (6.7%) strongly agreed, 1 (6.7%) agreed, 2 (13.3%) were not sure, 6 (40.0%) disagreed while 5 (33.3%) strongly disagreed. Rare use of charts, models and other teaching aids during Chemistry lessons was further established to affect learners' academic achievement with (mean= 3.8667, std. Dev. = 1.18723). Yusuf (2022) also established that rare use of charts, models and other teaching aids during Chemistry lessons affects learners' academic achievement. One of the respondents interviewed revealed that:

> *"Chemistry laboratory was not adequate for use by all learners. Library services were not adequate and therefore it affected learners' academic achievement. Chemistry course books at 1:1 ratio, was not adequate and therefore it affected learners' academic achievement."*

4.6 Learner Characteristics and Learners' Academic Achievement in Chemistry

On 3rd objective, two sets of questionnaires were also used to collect data on learner characteristics. Findings were presented in Table 4.8 and Table 4.9.

Table 4.11: Learner's Responses on Learner Characteristics

n=207		SA	A	NS	D	SD	Mean	Std. Dev
23. I enjoy learning Chemistry and this favourably influence my academic achievement in Chemistry	F	126	35	17	16	13	1.8164	1.24055
	%	60.9	16.9	8.2	7.7	6.3		
24. Since Chemistry is a difficult subject, I do not perform in School.	F	31	62	17	55	42	3.0725	1.40718
	%	15.0	30.0	8.2	26.6	20.3		
25. Since Chemistry is useful in my future career, I will perform favourably in KCSE.	F	65	58	16	39	29	2.5604	1.44980
	%	31.4	28.0	7.7	18.8	14.0		
26. Chemistry is not useful in my future career.	F	35	65	29	30	48	2.9565	1.43907
	%	16.9	31.4	14.0	14.5	23.2		
27. My favourable KCPE performance in science contributes to high academic achievement in Chemistry in KCSE examinations.	F	51	63	29	34	30	2.6570	1.38761
	%	24.6	30.4	14.0	16.4	14.5		
28. My low KCPE grade in science negatively influence my academic achievement in Chemistry in KCSE examinations.	F	47	72	16	30	42	2.7488	1.46966
	%	22.7	34.8	7.7	14.5	20.3		

The study sought to determine whether the learners enjoyed learning Chemistry and this favourably influenced their academic achievement in

Chemistry, 126 (60.9%) strongly agreed, 35 (16.9%) agreed, 17 (8.2%) were not sure, 16 (7.7%) disagreed while 13 (6.3%) strongly disagreed. Enjoying learning Chemistry was further established to affect learners' academic achievement with (mean= 1.8164, std. Dev. = 1.24055). Findings are in tandem with that of Ogembo et al. (2022) that enjoying learning Chemistry affects learners' academic achievement. In regards to whether since Chemistry is a difficult subject, the respondents do not perform in School, 31 (15.0%) strongly agreed, 62 (30.0%) agreed, 17 (8.2%) not sure, 55 (26.6%) disagreed while 42 (20.3%) strongly disagreed. Difficulty of Chemistry was further established to affect learners' academic achievement with (mean= 3.0725, std. Dev. = 1.40718). Findings agree with that of Langat (2020) that difficulty of Chemistry affects learners' academic achievement.

On whether Chemistry is useful in their future career, they will perform favourably in KCSE, 65 (31.4%) strongly agreed, 58 (28.0%) agreed, 16 (7.7%) not sure, 39 (18.8%) disagreed while 29 (14.0%) strongly disagreed. Usefulness of chemistry in the future career was further established to affect learners' academic achievement with (mean= 2.5604, std. Dev. = 1.44980). In a bid to establish whether chemistry is not useful in my future career, 35 (16.9%) strongly agreed, 65 (31.4%) agreed, 29 (14.0%) not sure, 30 (14.5%) disagreed while 48(23.2%) strongly disagreed. Chemistry not being useful in their future career was further established to affect learners' academic achievement with (mean= 2.9565, std. Dev. = 1.43907). Cherop (2023) also

established that chemistry not being useful in their future career affects learners' academic achievement.

Concerning whether favourable KCPE performance in science contributes to high academic achievement in Chemistry in KCSE examinations, 51 (24.6%) strongly agreed, 63 (30.4%) agreed, 29 (14.0%) not sure, 34 (16.4%) disagreed while 30 (14.5%) strongly disagreed. Favourable KCPE performance in science was further established to affect learners' academic performance with (mean= 2.6570, std. Dev. = 1.38761). The study agrees with that of Bittok (2019) that favourable KCPE performance in science affects learners' academic achievement. Finally, the study sought to determine whether low KCPE grade in science negatively influence my academic achievement in Chemistry in KCSE examinations, 47 (22.7%) strongly agreed, 72 (34.8%) agreed, 16 (7.7%) not sure, 30 (14.5%) disagreed while 42 (20.3%) strongly disagreed. Low KCPE grade in science was further established to affect learners' academic achievement with (mean= 2.7488, std. Dev. = 1.46966). The study is in agreement with that of Diana (2022) that low KCPE grade in science affects learners' academic achievement. Teachers' responses on Learner characteristics were presented in Table 4.9.

Table 4.12: Teacher's Responses on Learner Characteristics

n=15		SA	A	NS	D	SD	Mean	Std. Dev
25. My learners enjoy learning Chemistry and this favourably influence their academic achievement in Chemistry.	F	8	4	1	1	1	1.8667	1.24595
	%	53.32	26.73	6.72	6.74	6.74		
26. Since Chemistry is a difficult subject, my learners do not perform in school.	F	2	3	2	4	4	3.3333	1.44749
	%	13.32	20.02	13.32	26.74	26.75		
27. Since Chemistry is useful in the future career of learners, they perform favourably in KCSE.	F	2	2	2	4	5	3.5333	1.45733
	%	13.32	13.31	13.31	26.75	33.36		
28. My learners believe that high academic achievement in Chemistry is not useful in their future career aspirations.	F	2	1	1	5	6	3.8000	1.42428
	%	13.39	6.73	6.71	33.31	40.01		
29. My learners' KCPE grade in science contributes to high academic achievement in Chemistry in KCSE examinations.	F	9	3	1	1	1	1.8000	1.26491
	%	60.03	20.05	6.72	6.73	6.72		
30. My learners' low KCPE grade in science negatively influence academic achievement in Chemistry in KCSE examinations	F	3	5	2	3	2	2.7333	1.38701
	%	20.0	33.3	13.3	20.0	13.3		

The study was interested in determining whether their learners enjoy learning Chemistry and this favourably influenced their academic achievement in Chemistry, 8 (53.3%) strongly agreed, 4 (26.7%) agreed, 1 (6.7%) were not sure, 1 (6.7%) disagreed and 1 (6.7%) strongly disagreed. Enjoying learning Chemistry by learners was further established to affect learners' academic achievement with (mean= 1.8667, std. Dev. = 1.24595). The study by Cherop (2023) also established that enjoying learning Chemistry by learners affects learners' academic achievement. In a bid to establish whether since chemistry is a difficult subject, their learners do not perform in school, 2 (13.3%) strongly agreed, 3 (20.0%) agreed, 2 (13.3%) were not sure, 4 (26.7%) disagreed while 4 (26.7%) strongly disagreed. Chemistry being difficult subject was further established to affect learners' academic achievement with (mean= 3.3333, std. Dev. = 1.44749). Ebinum et al. (2020) also established that the perception that chemistry is a difficult subject affects learners' academic achievement.

In regards to whether since chemistry is useful in the future career of learners, they perform favourably in KCSE, 2 (13.3%) strongly agreed, 2 (13.3%) agreed, 2 (13.3%) not sure, 4 (26.7%) disagreed while 5 (33.3%) strongly disagreed. Usefulness of chemistry in the future career of learners was further established to affect learners' academic achievement with (mean= 3.5333, std. Dev. = 1.45733). The study by Cherop (2023) also established that usefulness of Chemistry in the future career of learners affects learners' academic achievement. On whether the learners believe that high academic achievement

in Chemistry is not useful in their future career aspirations, 2 (13.3%) strongly agreed, 1 (6.7%) agreed, 1 (6.7%) not sure, 5 (33.3%) disagreed while 6 (40.0%) strongly disagreed. High academic achievement in chemistry was further established to affect learners' academic achievement with (mean= 3.8000, std. Dev. = 1.42428). Findings are in tandem with that of Thapa (2019) that high academic achievement in chemistry affects learners' academic achievement

The study was interested in determining whether their learners' KCPE grade in science contributes to high academic achievement in Chemistry in KCSE examinations, 9 (60.0%) strongly agreed, 3 (20.0%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 1 (6.7%) strongly disagreed. Learners' KCPE grade in science was further established to affect learners' academic achievement with (mean= 1.8000, std. Dev. = 1.26491). The study is in agreement with that of Ebinum et al. (2020) that learners' KCPE grade in science affects learners' academic achievement.

Additionally, the study sought to determine whether their learners' low KCPE grade in science negatively influence academic achievement in Chemistry in KCSE examinations, 3 (20.0%) strongly agreed, 5 (33.3%) agreed, 2 (13.3%) not sure, 3 (20.0%) disagreed while 2 (13.3%) strongly disagreed. Learners' low KCPE grade in science was further established to affect learners' academic achievement with (mean= 2.7333, std. Dev. = 1.38701). The study agrees with that of Getachew (2018) that Learners' low KCPE grade in

science affects learners' academic achievement. One of the respondents interviewed revealed that:

> *"Most learners do not enjoy learning Chemistry and therefore it contributed to low grades in Chemistry in KCSE. Most learners consider chemistry as a difficult subject and that is why the learners do not perform well in this subject in school and also in KCSE examinations."*

4.7 Learning Environment and Learners' Academic Achievement in Chemistry

On 4th objective, two sets of questionnaires were used to collect data on Learning Environment and how it affects learners' academic achievement in chemistry. Findings were presented in Table 4.10 and Table 4.11.

Table 4.13: Learner's Responses on Learning Environment

n=207		SA	A	NS	D	SD	Mean	Std. Dev
29. Spacious classrooms in our school contribute to high academic achievement in Chemistry in KCSE.	F	26	17	17	44	103	3.8744	1.42572
	%	12.6	8.2	8.2	21.3	49.8		
30. Inadequate classrooms in our school contribute to low learners' academic achievement in Chemistry in KCSE.	F	39	37	16	76	39	3.1884	1.42388
	%	18.8	17.9	7.7	36.7	18.8		
31. Adequate Chemistry teacher-student ratio (1:40) in our school contributes to high academic achievement in Chemistry in KCSE.	F	33	50	14	55	55	3.2367	1.47042
	%	15.9	24.2	6.8	26.6	26.6		
32. Inadequate Chemistry teacher-student ratio (1:50 and more) in my school contributes to low academic achievement among learners.	F	72	30	33	42	30	2.6522	1.48611
	%	34.8	14.5	15.9	20.3	14.5		
33. Practicals when frequently done during Chemistry lessons favourably influence learners' academic achievement in KCSE.	F	42	123	17	13	12	2.1787	1.01538
	%	20.3	59.4	8.2	6.3	5.8		
34. Practicals when rarely done during Chemistry lessons negatively influence learners' academic achievement in KCSE.	F	129	33	16	16	13	1.7971	1.24143
	%	62.3	15.9	7.7	7.7	6.5		

In regards to whether inadequate classrooms in the school contribute to low learners' academic achievement in Chemistry in KCSE, 39 (18.8%) strongly agreed, 37 (17.9%) agreed, 16 (7.7%) not sure, 76 (36.7%) disagreed while 39 (18.8%) strongly disagreed. Inadequate classrooms in the school was further established to affect learners' academic achievement with (mean= 3.1884, std. Dev. = 1. 42388). Findings are similar with that of Gitogo (2018) that in adequate classrooms in the school affects learners' academic achievement.

The study also sought to determine whether adequate Chemistry teacher-student ratio (1:40) in the school contribute to high academic achievement in Chemistry in KCSE, 33 (15.9%) strongly agreed, 50 (24.2%) agreed, 14 (6.8%) were not sure, 55 (26.6%) disagreed and 55 (26.6%) strongly disagreed. Adequate chemistry teacher-student ratio (1:40) in the school was further established to affect learners' academic achievement with (mean= 3.2367, std. Dev. = 1. 47042). Mukra, et al. (2020) also established that adequate chemistry teacher-student ratio in the school affects learners' academic achievement

In regards to whether inadequate Chemistry teacher-student ratio (1:50 and more) in the school contributes to low academic achievement among learners, the response showed 72 (34.8%) strongly agreed, 30 (14.5%) agreed, 33 (15.9%) were not sure, 42 (20.3%) disagreed while 30 (14.5%) strongly disagreed. Inadequate Chemistry teacher-student ratio (1:50 and more) in the school was further established to affect learners' academic achievement with

(mean= 2.6522, std. Dev. = 1. 48611). The study by Khaombi (2021) also found that inadequate Chemistry teacher-student ratio in the school affects learners' academic achievement.

In relation to whether practicals when frequently done during Chemistry lessons favourably influence learners' academic achievement in KCSE, the response showed, 42 (20.3%) strongly agreed, 123 (59.4%) agreed, 17 (8.2%) not sure, 13 (6.3%) disagreed and 12 (5.8%) strongly disagreed. Practicals when frequently done during Chemistry lessons was further established to affect learners' academic achievement with (mean= 2.1787, std. Dev. = 1. 01538). The study agrees with that of Mwangi (2020) that practicals when frequently done during Chemistry lessons affects learners' academic achievement.

Additionally, the study sought to determine whether practicals when rarely done during chemistry lessons negatively influence learners' academic achievement in KCSE, the response showed, 129 (62.3%) strongly agreed, 33 (15.9%) agreed, 16 (7.7%) not sure, 16 (7.7%) disagreed and 13 (6.5%) strongly disagreed. Practicals when rarely done during chemistry lessons was further established to affect learners' academic achievement with (mean= 1.7971, std. Dev. = 1.24143). The study by Twoli (2023) also established that practicals when rarely done during chemistry lessons affects learners' academic achievement. Teachers' responses on learning environment were also sought and the findings were provided in Table 4.11 below.

Table 4.14: Teacher's Responses on Learning Environment

n=15		SA	A	NS	D	SD	Mean	Std. Dev
31. Spacious classrooms in our school contribute to high academic achievement in Chemistry in KCSE.	F	1	1	1	8	4	3.8667	1.12546
	%	6.7	6.7	6.7	53.3	26.7		
32. Inadequate classrooms in our school contribute to low learners' academic achievement in Chemistry in KCSE.	F	3	4	1	3	4	3.0667	1.57963
	%	20.0	26.7	6.7	20.0	26.7		
33. Adequate Chemistry teacher-student ratio (1:40) in our school contributes to high academic achievement in Chemistry in KCSE.	F	4	2	1	3	5	3.2000	1.69874
	%	26.7	13.3	6.7	20.0	33.3		
34. Inadequate Chemistry teacher-student ratio (1:50 and more) in my school contributes to low academic achievement among learners.	F	7	5	1	1	1	1.9333	1.22280
	%	46.7	33.3	6.7	6.7	6.7		
35. Practicals when frequently done during Chemistry lessons favourably influence learners' academic achievement in KCSE.	F	10	2	1	1	1	1.7333	1.27988
	%	66.7	13.3	6.7	6.7	6.7		
36. Practicals when rarely done during Chemistry lessons negatively influence learners' academic achievement in KCSE.	F	6	4	1	2	2	2.3333	1.49603
	%	40.0	26.7	6.7	13.3	13.3		

The study sought to determine whether spacious classrooms in the school contributes to high academic achievement in Chemistry in KCSE, 1 (6.7%)

strongly agreed, 1 (6.7%) agreed, 1 (6.7%) not sure, 8 (53.3%) disagreed and 4 (26.7%) strongly disagreed. Spacious classrooms in the school was further established to affect learners' academic achievement with (mean= 3.8667, std. Dev. = 1.12546). In relation to whether inadequate classrooms in the school contributes to low learners' academic achievement in Chemistry in KCSE, the response showed 3 (20.0%) strongly agreed, 4 (26.7%) agreed, 1 (6.7%) not sure, 3 (20.0%) disagreed and 4 (26.7%) strongly disagreed. Inadequate classrooms in the school was further established to affect learners' academic achievement with (mean= 3.0667, std. Dev. = 1.57963). Mukra, et al. (2020) also established that inadequate classroom in the school affects learners' academic achievement.

In regards to whether adequate Chemistry teacher-student ratio (1:40) in the school contributes to high academic achievement in Chemistry in KCSE, 4 (26.7%) strongly agreed, 2 (13.3%) agreed, 1 (6.7%) not sure, 3 (20.0%) disagreed and 5 (33.3%) strongly disagreed. Adequate Chemistry teacher-student ratio (1:40) in the school was further established to affect learners' academic achievement with (mean= 3.2000, std. Dev. = 1.69874). The study by Mwangi (2020) also found that adequate Chemistry teacher-student ratio in the school affects learners' academic achievement. In relation to whether inadequate Chemistry teacher-student ratio (1:50 and more) in the school contributes to low academic achievement among learners, 7 (46.7%) strongly agreed, 5 (33.3%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 1 (6.7%) strongly disagreed. Inadequate Chemistry teacher-student ratio (1:50 and more) in the school was further established to affect learners' academic

achievement with (mean= 1.9333, std. Dev. = 1.22280). The study agrees with that of Twoli (2023) that inadequate Chemistry teacher-student ratio in the school affects learners' academic achievement.

Out of the total respondents, 10 (66.7%) strongly agreed that practicals when frequently done during Chemistry lessons favourably influence learners' academic achievement in KCSE, 2 (13.3%) agreed, 1 (6.7%) not sure, 1 (6.7%) disagreed while 1 (6.7%) strongly disagreed. Practicals when frequently done during Chemistry lessons was further established to affect learners' academic achievement with (mean= 1.7333, std. Dev. = 1.27988). Cherop (2023) also established that practicals when frequently done, during Chemistry lessons affects learners' academic achievement. Lastly, on whether practicals when rarely done during Chemistry lessons negatively influence learners' academic achievement in KCSE, 6 (40.0%) strongly agreed, 4 (26.7%) agreed, 1 (6.7%) not sure, 2 (13.3%) disagreed while 2 (13.3%) strongly disagreed. Practicals when rarely done during Chemistry lessons was further established to affect learners' academic achievement with (mean= 2.3333, std. Dev. = 1.49603). The study by Gitogo (2018) also revealed that practicals when rarely done during Chemistry lessons affects learners' academic achievement. One of the respondents interviewed revealed that:

> *"Practicals were frequently being done during Chemistry lessons and therefore it contributed to improvement in learners' academic* achievement *in KCSE. When Chemistry teacher-student ratio is 1:40 in the school it contributes to high academic achievement in Chemistry in KCSE."*

4.8 Learners' Academic Achievement in Chemistry

The study also sought to determine learners' academic achievement in chemistry. Findings were presented in Table 4.12.

Table 4.15: Learner's Responses on Academic Achievement in Chemistry

n=207		SA	A	NS	D	SD	Mean	Std. Dev
Academic achievement in Chemistry has improved in the school	F	31	56	17	47	56	3.1981	1.46625
	%	15.0	27.1	8.2	22.7	27.1		
Learners record highest grades in Chemistry than other subjects in the school.	F	37	26	16	65	63	2.4976	1.41378
	%	17.9	12.6	7.7	31.4	30.4		
The high achievement in Chemistry is the most improved than other subjects in the school.	F	35	42	28	25	77	2.8164	1.39872
	%	16.9	20.3	13.5	12.1	37.2		
Learners doing STEM courses and who join university have increased over the years in the school.	F	50	61	27	30	39	2.7440	1.45053
	%	24.2	29.5	13.0	14.5	18.8		
Good academic achievement in Chemistry has contributed to an increase in the number of learners who join university	F	44	57	14	30	62	3.0435	1.57438
	%	21.3	27.5	6.8	14.5	30.0		

The study sought to determine whether achievement in chemistry has improved in the school, the response showed, 31 (15.0%) strongly agreed, 56 (27.1%) agreed, 17 (8.2%) not sure, 47 (22.7%) disagreed and 56 (27.1%) strongly disagreed. The item had a mean of 3.1981 and a variation in responses of 1.46625. This implies that the academic achievement in Chemistry had not significantly improved in the school. Kyalo (2020) also

established that achievement in Chemistry had not significantly improved in the schools. On whether learners record highest grades in chemistry than other subjects in the school, 37 (17.9%) strongly disagreed, 26 (12.6%) agreed, 16 (7.7%) not sure, 65 (31.4%) disagreed and 63 (30.4%) strongly disagreed. The item had a mean of 2.4976 and a standard deviation of 1.41378. This implies that the learners do not record highest grades in Chemistry than other subjects in the school. The study by Simiyu (2019) also found that learners do not record highest grades in Chemistry than other subjects.

In regards to whether academic achievement in Chemistry is the most improved than other subjects in the school, 35 (16.9%) strongly agreed, 42 (20.3%) agreed, 28 (13.5%) not sure, 25 (12.1%) disagreed while 77 (37.2%) strongly disagreed. The item recorded a mean of 2.8164 and a standard deviation of 1.39872. This implies that academic achievement in Chemistry is not the most improved than other subjects in the school. The findings are in tandem with that of Ogutu (2020) that the academic achievement in Chemistry is not the most improved than other subjects in the schools.

In establishing whether the learners doing STEM courses and who join university have increased over the years in the school, scores of 50 (24.2%) strongly agreed, 61 (29.5%) agreed, 27 (13.0%) not sure, 30 (14.5%) disagreed while 39 (18.8%) strongly disagreed were obtained. The itemized mean was 2.7440 and standard deviation was 1.45053. This implies that the learners doing STEM courses and who join university have increased over the

years in the school. The study is in agreement with that of Abdallah, et al. (2015) thatlearners doing STEM courses and who join university had increased over the years in the schools. Lastly, on whether good academic achievement in Chemistry has contributed to an increase in the number of learners who join university, 44 (21.3%) strongly agreed, 57 (27.5%) agreed, 14 (6.8%) not sure, 30 (14.5%) disagreed while 62 (30.0%) strongly disagreed. The item had a mean of 3.0435 and a standard deviation of 1.57438. This implies that good academic achievement in Chemistry has contributed to an increase in the number of learners who join university. Bittok (2019) also established that good academic achievement in Chemistry has contributed to an increase in the number of learners who join university. One of the respondents interviewed revealed that:

> *"Academic achievement in Chemistry was not the most improved subject in the school. However, the academic achievement in Chemistry had improved in the school. The learners doing STEM courses and who join university had increased over the years in the school."*

KCSE results document analysis template was used to collect learners' previous KCSE grades in Chemistry in the 18 different schools where the research was conducted. Findings were presented in Table 4.13.

Table 4.16: Learners' Previous KCSE Grades in Chemistry

		2018	2019	2020	2021	2022
B+	F	3	2	2	3	2
	%	16.7	11.1	11.1	16.7	11.1
B	F	2	7	2	1	4
	%	11.1	38.9	11.1	5.6	22.2
B-	F	2	5	4	3	4
	%	11.1	27.8	22.2	16.7	22.2
C+	F	5	3	5	10	5
	%	27.8	16.7	27.8	55.6	27.8
C	F	5	1	5	1	3
	%	27.8	5.6	27.8	5.6	16.7
C-	F	1	0	0	0	0
	%	5.6	0.0	0.0	0.0	0.0

Source: KNEC results as documented at the schools

The study sourced for KCSE results where the learners' previous KCSE grades in Chemistry were obtained and the results summarized in Table 4.13. In 2018, on average, 3 schools had a mean grade of B+ in chemistry, 2 in 2019, 2 in 2020, 3 in 2021 and 2 in 2022. This was represented by 16.7%, 11.1%, 11.1%, 16.7% and 11.1% respectively. In 2018, 2 schools had B, in 2019, 7 schools, in 2020, 2 schools, in 2021, 1 school and in 2020, 4 schools. This was represented by 11.1%, 38.9%, 11.1%, 5.6% and 22.2% respectively. In 2018, 5 schools had a mean grade of C+. In 2019, 3 schools, in 2020, 5 schools, in 2021, 10 schools and 5 schools in 2022. This was represented by 27.8%, 16.7%, 27.8%, 55.6% and 27.8% respectively. In 2018, 5 schools had

C, in 2019, 1 school, in 2020, 5 schools, in 2021, 1 school and in 2022, 3 schools. This was represented by 27.8%, 5.6%, 27.8%, 5.6% and 16.7% respectively. In 2018, 1 school had a C- and between 2019 and 2022 no other school had a C- as tabulated above.

4.9 Correlation Analysis

Correlation analysis was adopted to determine the relationship between the study variables. Findings were presented in Table 4.14.

Table 4.17: Correlation Analysis

n=207		Academic achievement	Teacher characteristics	Teacher & Learning resources	Learner characteristics	Learning Envt.
Performance	Pearson Correlation	1				
	Sig. (2-tailed)					
Teacher characteristics	Pearson Correlation	.709*	1			
	Sig. (2-tailed)	.000				
Teaching& Learning resources	Pearson Correlation	.524*	.601*	1		
	Sig. (2-tailed)	.000	.000			
Learner characteristics	Pearson Correlation	.897*	.240**	.668**	1	
	Sig. (2-tailed)	.000	.000	.000		
Learning Envt.	Pearson Correlation	.892*	.568**	.416**	.535**	1
	Sig. (2-tailed)	.000	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Teacher characteristics was found to have a strong significantly strong positive relationship with learners' academic achievement of ($r = .709$, p-value < 0.05). This implies that teacher characteristics contribute to improvement in learners' academic achievement. Findings are similar to that of Muse et al (2019) that a teacher characteristic enhances learners' academic achievement. Teaching and learning resources were found to have a significantly positive relationship with learners' academic achievement of ($r = .524$, p-value < 0.05). This implies that teaching and learning resources contribute to improvement in learners' academic achievement. The study is in agreement with that of Takwate (2018) that teaching and learning resources enhances learners' academic achievement.

Learner characteristics was found to have a strong significantly strong positive relationship with learners' academic performance of ($r = .897$, p-value < 0.05). This implies that Teacher and learning resources contribute to improvement in learners' academic achievement. Langat (2020) also observed that learner's characteristics improve learners' academic achievement. Learning environment was found to have a significantly positive relationship with learners' academic achievement of ($r = .892$, p-value < 0.05). This implies that learning environment contribute to improvement in learners' academic achievement. Findings are in tandem with that of Mwangi (2020) that learning environment enhances learners' academic achievement.

4.10 Multiple Regression analysis

The study adopted multiple linear regression analysis to facilitate prediction of learner's academic achievement from Teacher characteristics, Learner

characteristics, Teaching and learning resources and learning environment. Findings for the regression model were presented in Table 4.15;

Table 4.18: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.921[a]	.848	.845	1.42092

a. Predictors: (Constant), Teacher characteristics, Learner characteristics, Teaching and learning resources, learning environment

The adjusted R-square value is 0.845 which implies that the model explains 85.3% of learner's academic performance from the predictor variables (i.e., Teacher characteristics, Learner characteristics, Teaching and learning resources, Learning environment). Analysis of variance (ANOVA) was adopted to assess the goodness of fit test of the regression model. The results are shown in Table 4.16;

Table 4.19: ANOVA

	Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2269.588	4	567.397	281.026	.000b
	Residual	407.842	202	2.019		
	Total	2677.430	206			

a. Dependent Variable: Academic achievement

b. Predictors: (Constant), Teacher characteristics, Teaching and learning resources, Learner characteristics, Learning environment,

The value of the F test is F (4, 206) = 281.026, $p<0.05$. This implies that the model is reliable and learners' academic performance could be predicted from it. Regression coefficient analysis results were presented in Table 4.17.

Table 4.20: Regression Co-efficients

		Unstandardized Coefficients		**Standardized Coefficients**	**F**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	8.617	.986		8.742	.000
	Teacher characteristics	.297	.051	.207	5.725	.000
	Teaching and learning resources	.039	.046	.039	.844	.000
	Learner characteristics	.828	.036	.966	23.072	.000
	Learning environment	.093	.036	.085	2.589	.010

a. Dependent Variable: Academic achievement

Table 4.20 shows the regression coefficients results where by Teacher characteristics had a positive and significant effect on learners' academic

achievement of (β=.297, $p < 0.05$). This implies that when teacher characteristics gets better by one unit it enhances learners' academic achievement by .297 units when Teacher and learning resources, Learner characteristics and Learning environment are kept constant. Findings led to rejection of the null hypothesis (($H_0$1) that there is no significant relationship between teacher characteristics and the learners' academic achievement as measured by mean grade in Chemistry in KCSE. This implies that the alternative hypothesis (Ha1) that there is a significant relationship between teacher characteristics and the learners' academic achievement as measured by mean grade in Chemistry in KCSE was accepted. Findings are in tandem with that of Muse et al. (2019) those teacher characteristics enhance learners' academic achievement.

Teaching and learning resources had a positive and significant effect on learners' academic achievement of (β=.039, $p < 0.05$). This implies that an increase in Teacher and learning resources by one unit it enhances learners' academic achievement by .039 units when Teacher characteristics, Learner characteristics and Learning environment tare kept constant. Findings led to rejection of the null hypothesis ($H_0$2) that there is no significant relationship between adequacy of the teaching and learning resources and the learners' academic achievement as measured by mean grade in Chemistry in KCSE. This implies that the alternative hypothesis (H_a2) that there is a significant relationship between adequacy of the teaching and learning resources and the learners' academic achievement as measured by mean grade in Chemistry in

KCSE was accepted. The study agrees with that of Takwate (2018) that teaching and learning resources enhanced learners' academic achievement.

Learner characteristics had a positive and significant effect on learners' academic achievement of (β=.828, $p < 0.05$). This implies that an improvement in Learner characteristics by one unit it enhances learners' academic achievement by .828 units when Teacher characteristics, Teacher and learning resources and Learning environment tare kept constant. Findings led to rejection of the null hypothesis ($H_0$3) that there is no significant relationship between the learners' characteristics and the learners' academic achievement as measured by mean grade in Chemistry in KCSE. This implies that the alternative hypothesis (H_a3) that there is a significant relationship between the learner characteristics and the learners' academic achievement as measured by mean grade in Chemistry in KCSE was accepted. Learner characteristics enhanced learners' academic achievement. Langat (2020) also established that Learner characteristics enhance learners' academic achievement.

Learning environment had a positive and significant effect on learners' academic achievement of (β=.093, $p < 0.05$). This implies that an improvement in learning improvement by one unit it enhances learners' academic achievement by .093 units when Teacher characteristics, Teacher and learning resources and Learner characteristics are kept constant. Findings led to rejection of the null hypothesis ($H_0$4) that there is no significant

relationship between learning environment and the learners' academic achievement as measured by mean grade in Chemistry in KCSE. This implies that the alternative hypothesis (H_a4) that there is a significant relationship between learning environment and the learners' academic achievement as measured by mean grade in Chemistry in KCSE was accepted. Cherop (2023) also established that learning environment enhances learners' academic achievement.

The regression model was as follows.

$Y = 8.617 + 0.297X_1 + 0.039X_2 + 0.828X_3 + 0.093X_4$…………………...……...……Equation 4.1

The constant value of 8.617 implies that at zero Teacher characteristics, Teacher and learning resources, Learner characteristics, learners' academic achievement is at 8.617 units. The findings of the model reveal that of the total change in learners' academic achievement (Y), of the total change in learners' academic achievement, Teacher characteristics contributes 0.297. Of the total change in learners' academic achievement, teaching and learning resources contributes to 0.039. Of the total change in learners' academic achievement, Learner characteristics contributes 0.828 change in learners' academic achievement and of the total change in learners' academic achievement, learning environment contributes 0.093 change in learners' academic achievement.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of findings, conclusions and recommendations obtained. The chapter also presents the conclusion, recommendations and suggestions for further research.

5.2 Summary of Findings

The first objective of the study sought to establish the influence of teacher characteristics on the learners' academic achievement in Chemistry in Public Day Secondary Schools in Nandi East Sub County. The study established that the level of education of a Chemistry teacher influences the academic achievement of the learners in Chemistry in KCSE. Attending regularly in service training by Chemistry teacher helps to improve their skills in teaching. Chemistry teachers with longer years of service contribute favourably to higher learners' academic achievement in Chemistry in KCSE. Years of service of a Chemistry teacher favourably contribute to higher learners' academic achievement in Chemistry. Teachers who regularly attend in-service favourably influence learners' academic achievement while those who do not attend in-service regularly negatively affect learners' academic achievement.

The second objective of the study was to determine the influence of adequacy of teaching and learning resources on learners' academic achievement in Chemistry in Public Day Secondary Schools in Nandi East Sub County. The study established that adequacy of the chemistry laboratory affected learners'

academic achievement in Chemistry. In addition, not having a Chemistry laboratory affects learners' academic achievement in KCSE. Adequacy of library services affects learners' academic achievement, while inadequate library services affect learners' academic achievement. Both adequacy of laboratory apparatus and chemicals and inadequate laboratory apparatus and chemicals affect learners' academic achievement. Adequate Chemistry course books at 1:1 ratio was further established to affect learners' academic achievement. However, inadequate Chemistry course books (at 1:2 or more) in the school negatively affect learners' academic achievement. The use of charts, models and other teaching aids during Chemistry lessons by the Chemistry teacher was established to improve earners' academic achievement. Rarely using charts, models and other teaching aids during Chemistry lessons negatively influenced learners' academic achievement.

The third objective was to establish the influence of learner characteristics on learners' academic achievement in Chemistry in Public Day Secondary Schools in Nandi East Sub County. Learners who enjoy learning Chemistry were further established to influence learners' academic achievement. However, difficulty of Chemistry affects learners' academic achievement. Usefulness of chemistry in the future career affects learners' academic achievement. Chemistry not being useful in their future career affects learners' academic achievement. Favourable KCPE performance in science influence learners' academic performance. Low KCPE grade in science affects learners' academic achievement.

The fourth objective sought to establish the extent to which the learning environment influence learners' academic achievement in Chemistry in Public Day Secondary Schools in Nandi East Sub County. The study established that spacious classroom in the school affect learners' academic achievement. Inadequate classrooms in the school also affects learners' academic achievement. Adequate chemistry teacher-student ratio (1:40) in the school affects learners' academic achievement. Inadequate Chemistry teacher-student ratio (1:50 and more) in the school affects learners' academic achievement. Practical's when frequently done during Chemistry lessons affect learners' academic achievement. Practical's when rarely done during chemistry lessons affect learners' academic achievement.

5.3 Conclusions of the study

The study concluded that teacher characteristics affect learners' academic achievement in Chemistry in Public Day Secondary Schools. The study further concluded that the level of education of a Chemistry teacher influences the academic achievement in Chemistry in KCSE. Learners' academic achievement improves when Chemistry teachers attend in service trainings that improves their skills in teaching. Learners' academic achievement in Chemistry in KCSE improves when the Chemistry teachers who teach the students have longer years of service.

With regard to adequacy of teaching and learning resources, the study concluded that adequacy of the Chemistry laboratory affects learners'

academic achievement in Chemistry. When schools lack a Chemistry laboratory, it affects learners' academic achievement in KCSE. Learners' academic achievement improves when library services, laboratory apparatus and chemicals are adequate. Adequate Chemistry course books at 1:1 ratio enhances learners' academic achievement. The use of charts, models and other teaching aids during Chemistry lessons by the Chemistry teacher enhances learners' academic achievement.

Based on learner characteristics, the study concluded that learner characteristics enhances learners' academic achievement in Chemistry in Public Day Secondary Schools. Enjoying learning Chemistry enhances learners' academic achievement in chemistry in KCSE. Difficulty of Chemistry affects learners' academic achievement. Usefulness of Chemistry in the future career affects learners' academic achievement and KCPE performance in science influences learners' academic achievement. When KCPE grade in science is low, it affects learners' academic achievement.

In view of the learning environment, the study concluded that learning environment influences learners' academic achievement in Chemistry in Public Day Secondary Schools. When the classrooms are spacious, it affects learners' academic achievement. Inadequacy of classrooms in the school affects learners' academic achievement. Learners perform better in Chemistry when the schools have adequate Chemistry teacher-student ratio (1:40). Learners' academic achievement improves when practicals are done frequently during Chemistry lessons.

5.4 Recommendations

The study came up with the following recommendations;

On teacher characteristics, the study recommended that chemistry teachers should continue to improve on their level of education as it contributes to improvement in learners' academic achievement in Chemistry in KCSE. Chemistry teachers should continue to attend in service trainings regularly as it improves their skills in teaching.

Regarding adequacy of teaching and learning resources, the study recommended that schools should have Chemistry laboratories as they affect learners' academic achievement in KCSE. The schools should offer adequate library services and the laboratory apparatus and chemicals should be adequate at all the time. The Chemistry course books should be adequate at 1:1 ratio and that Chemistry teachers should continue to use of charts, models and other teaching aids during Chemistry lessons as they enhance learners' academic achievement.

Concerning learner characteristics, the study recommended that Learners should enjoy learning Chemistry for them to record an improvement in learners' academic achievement in Chemistry in KCSE. The learners should consider the usefulness of Chemistry in their future career because it affects their career aspirations.

Additionally on learning environment, the study recommended that classrooms in schools should be spacious, and adequate. Schools should have

adequate chemistry teacher-student ratio (1:40). The practicals should be done frequently during Chemistry lessons.

5.5 Suggestions for Further Research

The current study was done on factors influencing learners' academic achievement in chemistry in public day secondary schools in Nandi East Sub County.

The study recommends a similar study should be done in other sub-Counties with in Nandi County and other Counties in Kenya by another researcher. This will help to enhance the existing body of knowledge on factors influencing learners' academic achievement in Chemistry in public day secondary schools.

The study also recommends that a similar study should be done in any sub-county or county of choice; however researchers should adopt other factors that influence learners' academic achievement in Chemistry in public day secondary schools besides Teacher characteristics, Teacher and learning characteristics, Learner characteristics and learning environment which were adopted in this study. This will help to enhance the existing body of knowledge on the subject matter.

Other studies should focus on the same subject matter but consider other sciences besides Chemistry alone.

REFERENCES

Adesoji,F. A., & Olatunbosun, S. M. (2022). *Student, teacher and school environment factors* as determinants of achievement in senior Secondary School Chemistry in Oyo State, Nigeria. *Journal of International Social Research, 1* (2), 43-47.

Adiele, F. (2021) . *Teacher behaviour and students learning Students learning approach and effectiveness*. Ibadan: Evans Brothers.

Abdala, A., Ali, H.I., Ahmed, S.A., Kasim, A.M., Elmoge, N.Y., Amuor, A.A. (2019). Factors affecting students' performance in Chemistry: case study in Zanzibar Secondary Schools. *Global Journal of Management Studies, 3* (1), 17-25.

Akani, O. (2020). Laboratory Teaching: Implication on Students' Achievement in Chemistry in Secondary Schools in Ebonyi State of Nigeria. *Journal of Education and Practice, 6* (30), 206-213.

Alavi, H. R., & Hoseini, A. R. (2022). The effect of educational factors on the academic performance of the university students in chemistry. *Chemical Education Journal, 2* (1), 13-14.

Best, J., & Kahn, J. (2019). *Research in education* (9th ed.). New Delhi: Prentice Hall.

Bittok, N. (2019). An investigation of Factors contributing to poor performance in Chemistry among girls in secondary schools in Nandi North sub-county, Kenya. *International Journal of Education Studies, 2* (1), 11-15.

Bhai Moiz & Irina Horoi (2019). Teacher characteristics and academic achievement, Applied Economics, 51:44, 4781-4799, DOI: 10.1080/000368446.2019.1597963

Cherop, C.J. (2023). Institutional factors influencing students' achievement in Chemistry Curriculum in Trans-Nzoia County, Kenya. *International Journal of Multidisciplinary Studies, 3* (1), 123-130.

Copriady, J., Zulnaidi, H., & Alimin, M. (2021). Inservice training for chemistry teachers' proficiency: The intermediary effect of collaboration based on teaching experience. *Educational Studies Journal, 1* (1), 07-11.

Diana, R. (2022). Rearing competent children in child-development-today and tomorrow. *Harvard Review, 2* (1), 13-19.

Ebinum, U. S., Akamagune, N.E., & Ugbong, B. I. (2017). The relationship between school distance and academic achievement of primary school pupils in Ovia North-East LGA, Edo State Nigeria. *International Journal of Education and Business Studies, 2* (1), 25-31.

Getachew, B. (2018). Factors affecting student's academic performance in Ahuntegen general secondary school, North Wollo Zone, Ethiopia. *Journal of Education and Learning (EduLearn), 12* (2), 198-206.

Gitogo, G.I. (2018). Perception and trends in academic performance of secondary school students with a Public and private primary school background: a case study of Alliance National Secondary Schools, Kenya. *Educational Studies, 3* (2), 117-125.

Halladyna, T., & Shaughnessy, J. (2021). Attitudes towards science: A qualitative synthesis. *Journal of Research in Science Teaching, 66* (4), 547-563.

Isiola, O.M. (2021). Effect of standardized and improvised instructional materials on students' academic achievement in secondary school physics. *International Journal of Education, 2* (2), 17-22.

Junejo, M.I., Sarwar, S., & Ahmed, R.R. (2021). Impact of in-service training on performance of teachers. A case of STEVTA Karachi Region. Global of Multi-Disciplinary Studies, 3 (3), 111-120.

Kirwa, M.R.A. (2023). Factors leading to the poor performance in chemistry in selected secondary schools of Kabiyet division, Nandi north district Kenya. *International Journal of Education and Physical Studies, 25* (1), 3019-3023.

Khaombi, C. (2021). Factors affecting KCSE performance in Chemistry in Public Secondary Schools: A Case study of selected public secondary schools in Lugari Sub-County, Kakamega County, Kenya. *Havard Review, 2* (2), 33-37.

KNEC Chemistry Report 2022.pdf. retrieved on 5/7/2023

Kyalo, B.M. (2020). School based factors influencing students' performance in Chemistry in Kenya Certificate of Secondary Education in Makueni County Kenya. *Education Studies, 3* (1), 04-10.

Langat, C.A. (2020). Students' attitudes and their effects on learning and achievement in mathematics: a case study of public secondary schools

in Kiambu County, Kenya. *Global Journal of Social Sciences, 3* (1), 55-61.

Mukra, R., Silitonga, A., & Restuati, F. (2020). Analysis on facilities and intensity of Utilisation of biology laboratory in four state schools in Medan, Indonesia. *Global Journal of Social Studies, 3* (1), 01-07.

Muse, B., Ndirangu, C., & Imonje, R., (2019). Determinants of implementing chemistry curriculum in Arid and Semi-Arid Lands: A case of Secondary Schools in Garissa. *Havard Review, 3* (1), 67-71.

Mwangi, J. T. (2020). Effect of chemistry practicals on students' performance in Chemistry in public secondary schools of Machakos and Nairobi Counties in Kenya. *Global Journal of Education, 4* (1), 987-995.

Nakayama, M., Yamamoto, H., & Santiago, R. (2018). The impact of learner characteristics on learning performance in hybrid courses among Japanese Students. *Electronic Journal of E-Learning, 5* (3), 195-206.

Njagi, W.M., & Silas, N.E. (2021). Relevance of Kenya Secondary School chemistry instruction in preparation of students pursuing chemistry at University Level. *International Journal for Innovation Education and Research, 2* (1), 5-10.

Ogembo, O.J., Otanga, H., & Yaki, N.R. (2022). Students' and Teachers' attitude and performance in Chemistry in Secondary Schools in Kwale County Kenya. *Global Journal of Business Studies, 2* (2), 111-120.

Ogutu, E. A. (2020). Institutional based factors affecting effective teaching in Chemistry: a survey of secondary school teachers in Naivasha sub county Nakuru County. *Business Review, 3* (1), 33-40.

Ojukwu, M.O. (2022). Perception of student on causes of poor performance in Chemistry in External Examinations in Umuahi North Local Government of Abia State. *Global Journal of Business Studies, 2* (2), 13-19.

Olubu, M.O. (2020). Influence of laboratory environment on student academic performance in Secondary School Chemistry. *Global Journal of Accounting Studies, 3* (1), 17-25.

Otieno, K. O. (2021). Teaching/learning resources and academic performance in mathematics in secondary schools in Bondo District of Kenya. *Asian Social Science, 6* (12), 126-131.

Siddiqui, M. (2011). *Advanced educational psychology*. New Delhi: S.B Nangia.

Simiyu, P.C. (2019*).* Influence of institutional and learner's characteristics on students' academic achievement in public day secondary schools in Trans-Nzoia and West Pokot counties, Kenya. *Multidisciplinary Studies, 3* (1), 81-90.

Sirhan, G. (2020). Learning difficulties in chemistry: an overview. *Journal of Turkish Science Education, 4* (2), 2-20.

Takwate, K.T. (2018). Planning, allocative and administrative efficiency of school facilities management as correlates of academic performance of Senior Secondary School students in Adawama State, Nigeria. *Journal of Management, 2* (1), 63-66.

Tanwar, P. (2021). A study on achievement in chemistry at higher secondary stage. *Global Journal of Management Studies, 3* (1), 77-81.

Thapa, A. (2019). Public and private school performance in Nepal: an analysis using the SLC examination. *Education Economics, 23* (1), 47-62.

Thuranira, J. M., Ikiara, L., & Thuba, E. (2022). Influence of Teaching Learning Resources on Academic Performance among Public Primary Schools in Laikipia West Sub-County. Journal of Education, 2 (3), 1-9.

Twoli, W. (2023). *Teaching secondary school chemistry, A textbook for teachers in developing*

countries. Nairobi. Nehenia Publishers.

Ugwe, N. (2023). *The world educational crisis: A systems analysis*. New York. Oxford University Press.

UNESCO (2020). *Education for sustainable development goals*. United Nation Educational Scientific and Cultural Organization. France: Paris. (Online).Retrieved from https://unesdoc.org/images/0024/002474/247444e.pdf

Usman, Y. D., & Madudili, C. G. (2019). Evaluation of the effect of learning environment on students' academic performance in Nigeria. *Journal of Management, 2* (1), 17-25.

Vilia, P. N., Candeias, A. A., Neto, A. S., Franco, M. D. G. S., & Melo, M. (2021). Academic achievement in physics-chemistry: The predictive effect of attitudes and reasoning abilities. *Frontiers in Psychology, 8* (1), 1064-1070.

Wanjala, G. (2021). An assessment of the contribution of education to entrepreneurial development in Kenya. *International Journal of Management Studies, 3* (1), 63-70.

Yusuf, H. (2022). Effect of class size on the listening skills of primary (5) students in Zaria

Local Government Area of Kaduna State. *Asian Journal of Management & Education, 3* (1), 14-19

APPENDICES

APPENDIX I: LETTER OF INTRODUCTION TO RESPONDENT

Jebotip Veronica,

Koitaleel Samoei University College,

University of Nairobi,

P.O. Box 5-30307,

Mosoriot.

20/02/2023.

To the Principal

……

Dear Sir/Madam,

RE: REQUEST TO PARTICIPATE IN ACADEMIC RESEARCH

I am Jebotip Veronica, a student undertaking a Master of Education Degree at Koitaleel Samoei University College (A Constituent College of the University of Nairobi). In partial fulfilment for requirement of the degree, I am supposed to carry out a research project. The study is based on **"Factors Influencing Learners' Academic Achievement in Chemistry in public day secondary schools in Nandi East Sub County, Kenya."** Please respond to the items in the questionnaires as honestly as possible. Your identity will be treated confidentially and the information provided will be used for the purpose of this study only.

Thank you in advance.

……

Yours faithfully,

Jebotip Veronica

APPENDIX II: QUESTIONNAIRE FOR STUDENTS

Dear student

This questionnaire has two parts; part one and two. Kindly respond to all the items by placing a tick (√) on multiple choices and by writing a response to open ended items

PARTONE: Background Information

1. Please indicate your gender. Male [] Female []
2. How old are you? [15-17] [18-21] [any other specify……]
3. What grade did you score in science in KCPE? A [] B [] C [] D[]
4. What is the average number of students in your present class(stream)? (0-10) (11-20) (21-30) (31-39) (40-44) (above 45)

PART TWO.A) Teacher characteristics and academic achievement

For each item kindly respond by using a tick (√) to indicate whether you Strongly Agree (**SA**), Agree**(A)**, Not Sure (**NS**), Disagree(**D**), Strongly Disagree (**SD**) with the item.

Statement	**SA**	**A**	**NS**	**D**	**SD**
5. The level of education of a Chemistry teacher has a favorable influence on our academic achievement in Chemistry in KCSE					
6. The level of education of a Chemistry teacher does not have a favorable influence on our					

academic achievement in Chemistry in KCSE					
7. Our Chemistry teachers regularly attend in service training to improve their skills in teaching.					
8. Our Chemistry teachers rarely attend in service training to improve their skills in teaching.					
9. Chemistry teachers with longer years of service contribute favorably to high learners' academic achievement in Chemistry in KCSE.					
10. The years of service of a Chemistry teacher does not favorably contribute to high learners' academic achievement in Chemistry.					
11. Teachers who regularly attend in-service favorably influence learners' academic achievement.					
12. Teachers who do not attend in-service regularly influence learners' academic achievement.					

B) Teaching and learning resources and academic achievement.

For each item kindly respond by using a tick (√) to indicate whether you Strongly Agree (**SA**), Agree **(A)**, Not Sure (**NS**), Disagree (**D**), Strongly Disagree (**SD**) with the item.

ITEM	SA	A	NS	D	SD
13. Our Chemistry laboratory is adequate for use by all learners.					
14. Our school does not have a Chemistry laboratory and this negatively influence learners' academic achievement in KCSE.					
15. Adequate library services contribute to high academic achievement among learners.					
16. Inadequate library services contribute to low academic achievement among learners.					
17. Adequate laboratory apparatus and chemicals positively influence learners' academic achievement in Chemistry in KCSE.					
18. Inadequate laboratory apparatus and chemicals negatively influence learners' academic achievement in Chemistry in KCSE.					
19. Adequate Chemistry course books at 1:1 ratio contributes to high learner academic achievement.					
20. Inadequate Chemistry course books (at 1:2 or more) in our school contributes to low learner academic achievement.					
21. Our chemistry teacher always uses charts, models and					

other teaching aids during chemistry lessons which positively influence learners' academic achievement.					
22. Our chemistry teacher rarely uses charts, models and other teaching aids during chemistry lessons and hence negatively influence learners' academic achievement.					

C) Learner characteristics and academic achievement

For each item kindly respond by using a tick (√) to indicate whether you Strongly Agree (**SA**), Agree **(A)**, Not Sure (**NS**), Disagree (**D**), Strongly Disagree (**SD**) with the item.

ITEM	**SA**	**A**	**NS**	**D**	**SD**
23. I enjoy learning Chemistry and this favorably influence my academic achievement in Chemistry.					
24. Since Chemistry is a difficult subject, I do not perform in School.					
25. Since Chemistry is useful in my future career, I will perform favorably in KCSE.					
26. Chemistry is not useful in my future career.					
27. My favorable KCPE performance in science contributes to high academic achievement in Chemistry in KCSE examinations.					

28. My low KCPE grade in science negatively influence my academic achievement in Chemistry in KCSE examinations.					

D) Learning environment and academic achievement

For each item kindly respond by using a tick (√) to indicate whether you Strongly Agree (**SA**), Agree **(A)**, Not Sure (**NS**), Disagree (**D**), Strongly Disagree (**SD**) with the item.

ITEM	**SA**	**A**	**NS**	**D**	**SD**
29. Spacious classrooms in our school contributes to high academic achievement in Chemistry in KCSE.					
30. Inadequate classrooms in our school contributes to low learners' academic achievement in Chemistry in KCSE.					
31. Adequate Chemistry teacher-student ratio (1:40) in our school contributes to high academic achievement in Chemistry in KCSE					
32. Inadequate Chemistry teacher-student ratio (1:50 and more) in my school contributes to low academic achievement among learners.					
33. Practicals when frequently done during Chemistry lessons favorably influence learners' academic achievement in KCSE.					

34. Practicals when rarely done during Chemistry lessons negatively influence learners' academic achievement in KCSE.					

E) Learner's Academic Achievement

For each item kindly respond by using a tick (√) to indicate whether you Strongly Agree (**SA**), Agree **(A)**, Not Sure (**NS**), Disagree (**D**), Strongly Disagree (**SD**) with the item.

ITEM	**SA**	**A**	**NS**	**D**	**SD**
35. Academic achievement in Chemistry has improved in the school.					
36. Learners record highest grades in Chemistry than other subjects in the school.					
37. The performance in Chemistry is the most improved than other subjects in the school.					
38. Learners doing STEM courses and who join university have increased over the years in the school.					
39. High academic achievement in Chemistry has contributed to an increase in the number of learners who join university.					

APPENDIX III: QUESTIONNAIRE FOR CHEMISTRY TEACHERS

Dear respondent,

The purpose of this questionnaire is to obtain information about the factors influencing learners' academic achievement in Chemistry in Kenya. You are kindly requested to complete all items in this questionnaire by either ticking (√) or filling in the appropriate response in the spaces given.

PART ONE: Background information

1. Indicate your gender? Male [] Female []
2. Give your highest academic qualification? Doctorate [ ] Master Degree [ ] B ED. [ ] Diploma [ ] Teacher trainees [ ] Untrained teacher [ ]
3. How many years have you been teaching? Below 1 year [ ] 1 – 5 years [ ] 6 - 10 years [ ] 11 - 15 years [ ] 16-20 years [ ] above 20 years [ ]
4. Indicate the number of chemistry teachers in your school……
5. Indicate the number of in-service trainings you have attended……
6. Which interaction styles do you use while teaching chemistry? Lecture method [] Practical approach [ ] Demonstration method [ ]

PART TWO.A) Teacher characteristics and academic achievement

For each item kindly respond by using a tick (√) to indicate whether you Strongly Agree

(**SA**), Agree **(A)**, Not Sure (**NS**), Disagree (**D**), Strongly Disagree (**SD**) with the item.

ITEM	SA	A	NS	D	SD
7. The level of education of a Chemistry teacher favorably influences learners' academic achievement in Chemistry in KCSE.					
8. The level of education of a Chemistry teacher negatively influences leaners' academic achievement in Chemistry in KCSE.					
9. Chemistry teachers in my school regularly attend in service training to improve their skills in teaching.					
10. Chemistry teachers in my school rarely attend in service training to improve their skills in teaching.					
11. Longer years of experience in teaching Chemistry contribute favorably to high learners' academic achievement in Chemistry.					
12. Few years of teaching Chemistry negatively influence learners' academic achievement in Chemistry in KCSE.					
13. Teachers who regularly attend in-service (1-2 times a year) favorably influence learners' academic achievement.					
14. Teachers who do not attend in-service regularly negatively influence learners' academic achievement.					

B) Teaching and learning resources and academic achievement

For each item kindly respond by using a tick (√) to indicate whether you Strongly Agree (**SA**), Agree **(A)**, Not Sure (**NS**), Disagree (**D**), Strongly Disagree (**SD**) with the item.

ITEM	**SA**	**A**	**NS**	**D**	**SD**
15. Our Chemistry laboratory is adequate for use by all learners.					
16. Our school does not have a Chemistry laboratory and this negatively influence learners' academic achievement in KCSE.					
17. Adequate library services contribute to high academic achievement among learners.					
18. Inadequate library services contribute to low academic achievement among learners.					
19. Adequate laboratory apparatus and chemicals positively influence learners' academic achievement in Chemistry in KCSE.					
20. Inadequate laboratory apparatus and chemicals negatively influence learners' academic achievement in Chemistry in KCSE.					
21. Adequate Chemistry course books at 1:1 ratio contributes to high learner academic achievement.					

22. Inadequate Chemistry course books (at 1:2 or more) in our school contribute to low learner academic achievement.					
23. I always use charts, models and other teaching aids during Chemistry lessons which positively influence learners' academic achievement.					
24. I rarely use charts, models and other teaching aids during Chemistry lessons and this negatively influence learners' academic achievement.					

C) Learner characteristics and academic achievement

For each item kindly respond by using a tick (√) to indicate whether you strongly Agree (**SA**), Agree **(A)**, Not Sure (**NS**), Disagree (**D**), and Strongly Disagree (**SD**) with the item.

ITEM	**SA**	**A**	**NS**	**D**	**SD**
25. My learners enjoy learning Chemistry and this favorably influence their academic achievement in Chemistry.					
26. Since Chemistry is a difficult subject, my learners do not perform in school.					
27. Since Chemistry is useful in the future career of learners, they perform favorably in KCSE.					

28. My learners believe that high academic achievement in Chemistry is not useful in their future career aspirations.					
29. My learners' KCPE grade in science contributes to high academic achievement in Chemistry in KCSE examinations.					
30. My learners' low KCPE grade in science negatively influence academic achievement in Chemistry in KCSE examinations.					

D) Learning environment and academic achievement

For each item kindly respond by using a tick (√) to indicate whether you Strongly Agree (**SA**), Agree **(A)**, Not Sure (**NS**), Disagree (**D**), Strongly Disagree (**SD**) with the item.

ITEM	**SA**	**A**	**NS**	**D**	**SD**
31. Spacious classrooms in our school contribute to high academic achievement in Chemistry in KCSE.					
32. Inadequate classrooms in our school contribute to low learners' academic achievement in Chemistry in KCSE.					
33. Adequate Chemistry teacher-student ratio (1:40) in our school contributes to high academic achievement in Chemistry in KCSE.					

34. Inadequate Chemistry teacher-student ratio (1:50 and more) in my school contributes to low academic achievement among learners.					
35. Practicals when frequently done during Chemistry lessons favorably influence learners' academic achievement in KCSE.					
36. Practicals when rarely done during Chemistry lessons negatively influence learners' academic achievement in KCSE.					

APPENDIX IV: INTERVIEW SCHEDULE FOR SECONDARY SCHOOL PRINCIPAL

The purpose of this interview is to obtain information about the factors influencing learner academic achievement in Chemistry in Nandi East Sub County, Kenya.

1. How long have you been teaching? ....

   .....

2. How many years have you been in the administrative office?.....
3. How many Chemistry teachers per class do you have?.....
4. What is the influence of teacher characteristics on the learner academic achievement in Chemistry in your school? (Refer to: education level, years of service, in-serve training)
5. What is the influence of availability of teaching and learning resources on the learner academic achievement in Chemistry in your school? (Refer to: teacher-student ratio, laboratory, library, leaner-textbook ratio)
6. To what extent do the learner characteristics influence their academic achievement in Chemistry in your school? (Refer to age, gender, attitude, future career)

7. What is the extent to which the learning environment influences learner academic achievement in Chemistry in your school? (Refer to: frequency of practicals, teacher-student ratio, class size)
8. In your opinion, how do you rate learners 'academic achievement in sciences subject in in your school in Chemistry? (Refer to: very high, high, average, below average, dismal)
9. What factor in your view has most influence on learners' academic achievement in your school? (Refer to teacher, learner, teaching and learning resources and learning environment).

APPENDIX V: KCSE RESULTS DOCUMENT ANALYSIS

TEMPLATE FOR PRINCIPALS

Dear Principal,

Kindly provide Chemistry KCSE mean grade of your school

KCSE YEAR	CHEMISTRY SCORE	REMARK
2018		
2019		
2020		
2021		
2022		

APPENDIX VI: KREJCIE AND MORGAN SAMPLE DETERMINATION TABLE

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Kreicie & Morgan, 1970

APPENDIX VII: RESEARCH PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **159092**

Date of Issue: **02/March/2023**

RESEARCH LICENSE



This is to Certify that Miss.. VERONICA JEBOTIP of Koitaleel Samoei University College, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nandi on the topic: FACTORS INFLUENCING LEARNERS' ACADEMIC ACHIEVEMENT IN CHEMISTRY IN PUBLIC DAY SECONDARY SCHOOLS IN NANDI EAST SUB COUNTY, KENYA. for the period ending : 02/March/2024.

License No: **NACOSTI/P/23/24063**

159092

. Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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See overleaf for conditions

APPENDIX VIII: RESEARCH AUTHORIZATION

OFFICE OF THE PRESIDENT

MINISTRY OF INTERIOR AND NATIONAL ADMINISTRATION

Tel: 053 5252621, 5252003, Kapsabet
Fax No. 053 – 5252503
E-mail:
nandicountycommissioner@gmail.com
When replying, please quote

County Commissioner's Office,
Nandi County
P.O. Box 30,
KAPSABET.

Ref: No. NC.ADU.4/3 VOL.II/(10)

17th March, 2023

Veronica Jebotip,
Koitaleel Samoei University College,
P.O. Box 5 - 30307,
MOSORIOT.

RE: RESEARCH AUTHORIZATION

This is in reference to letter No. NACOSTI/P/23/24063 dated 2nd March, 2023 from the Director General/CEO, National Commission for Science, Technology and Innovation on the above subject matter.

You are hereby authorized to conduct a research on **"Factors Influencing Learners' Academic Achievement in Chemistry in Public Secondary Schools in Nandi East Sub County"** for the period ending **2nd March, 2024.**

Wishing you all the best.

THE COUNTY COMMISSIONER NANDI.

H.M. SHAMBI 'ndc' (K)
COUNTY COMMISSIONER,
NANDI.

ASANTE KWA KUDUMISHA AMANI: ENDELEA HIVYO NA MUNGU AKUBARIKI

REPUBLIC OF KENYA

MINISTRY OF EDUCATION STATE DEPARTMENT FOR EARLY LEARNING AND BASIC EDUCATION

Email: cdenandicounty@yahoo.com
Telephone: 0773044624
When replying please quote

County Director of Education
NANDI COUNTY,
P. O. Box 36-30300,
KAPSABET.

Ref: NDI/CDE/RESEARCH/1/VOL.111/66

Date 17/3/2023

Veronica Jebotip
Koitaleel Samoei University
P.O Box 5-30307
MOSORIOT

RE: RESEARCH AUTHORISATION.

Reference is made to the letter Ref: No. NACOSTI/P/23/24063 dated 2nd March, 2023 on the above subject.

The above named person has been granted permission by the County Director of Education to carry out research on ***"Factors Influencing Learners' Academic Achievement in Chemistry in Public Day Secondary Schools in Nandi East Sub County in Nandi County Kenya*** for the period ending **2nd March, 2024.**

Kindly provide her all necessary support she requires.

For: County Director of Education
NANDI COUNTY

Odongo J. O
For: County Director of Education,
NANDI COUNTY.

FACTORSINFLUENCING LEARNERS' ACADEMIC ACHIEVEMENT INCHEMISTRY INPUBLIC DAY SECONDARY SCHOOLS IN NANDI EAST SUB COUNTY, NANDI COUNTY, KENYA

ORIGINALITY REPORT

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