AN INVESTIGATION OF FACTORS CONTRIBUTING TO POOR PERFORMANCE IN CHEMISTRY AMONG GIRLS IN SECONDARY SCHOOLS IN NANDI NORTH SUB-COUNTY, KENYA.

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DECLARATION

DECLARATION BY THE STUDENT

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

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To my husband, Mr. Kulei, my children Gerson, Given, Valentine and Gerald.

ABSTRACT

Chemistry is one of the most important branches of science and its contributions to development of a country need to be emphasized. Its performance, however, has been poor especially amongst girls. The purpose of this study was to determine the factors influencing the performance of girls in chemistry in secondary schools in Nandi North Sub-County, Nandi County, Kenya. The specific objectives were to; investigate the attitude of girls towards learning of chemistry, establish the type of teacher interaction styles used in teaching chemistry, determine the influence of availability of teaching and learning materials on secondary school students' performance in chemistry and investigate the perception of teachers towards teaching of chemistry. Descriptive survey research design was adopted. The sample consisted of 303 Form three students and 9 chemistry teachers selected using proportionate, simple random and purposive sampling techniques. Questionnaires, interviews and observation schedules were used to collect data. Validity and reliability of these instruments were determined before data collection. Quantitative data were analyzed using frequencies, percentages and t-test while qualitative data were transcribed and arranged thematically before reporting in narrations and quotations. The study found out that there was a significant difference between boys and girls in terms of attitude towards Chemistry. It emerged that there was a significant difference between male and female students ($p \leq .05$) on effect of teacher interaction styles used in chemistry on students' achievement. However, the study found that there was no significant difference on the mean of boys and girls on influence of availability of teaching and learning materials on students' achievement in chemistry ($p \geq .05$).The study findings showed that majority (68.1%) of male students believed that they were sure of learning chemistry while majority (57.4%) of the female students were not sure of learning chemistry, pointing out poor confidence among girls in learning chemistry. The study found that there was no significant difference on the mean of boys and girls on influence of availability of teaching and learning materials on students' achievement in chemistry ($p \geq .05$). Further the findings showed that majority of the students believed that there were no well-equipped chemistry laboratories in their schools thus making student not to be acquainted to practicals. The analysis also showed that background characteristics and teacher's negative attitude towards learners' ability in chemistry were the main causes of persistent poor performance. The study recommended that teachers of chemistry need to encourage and motivate girls to develop a positive attitude toward the importance of chemistry as a subject. Further, teachers of chemistry need to be aware of the best instructional strategies that motivate girls to like chemistry. Furthermore, there is need for the government and other education stakeholders to provide adequate and relevant teaching and learning materials which motivates students to learn Chemistry. The findings of this study could provide a framework for teachers on which they could re-evaluate their instructional strategies during chemistry lessons for the enhancement of effective teaching and learning. It could also provide insight for the curriculum designers into the kind of practical experiences in secondary school chemistry needed to aid sound understanding of scientific concepts and principles. Further the study findings could provide a framework for the KNEC on which it could re-evaluate their objectives and objectives so that the practices during secondary school chemistry lessons especially practicals are in line with what the curriculum demands on students.

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LIST OF ABBREVIATIONS AND ACRONYMS

CAPs	Curriculum and Assessment Policy
CCE	Cooperative Class Experiment
COS	Classroom Observation Schedule
IPAR	Institute of Policy Analysis and Research
KCSE	Kenya Certificate of Secondary Education
KNEC	Kenya National Examination Council
NACOSTI	National Commission of Science, Technology and innovations
NAEP	National Assessment of Educational Progress
SACE:	South African Council for Educators
SPSS	Statistical Package for Social Sciences
STR	Student-Teacher Ratio
TSC	Teachers Service Commission
UNSECO	United Nations Educational, Scientific and Cultural Organization

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CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1Overview

This chapter presents background information to the study and statement of the problem. It also highlights the purpose of the study, its objectives, research questions, justification, significance of the study, scope, assumption and limitations of the study. It also explains the conceptual framework and the operational definition of key terms.

1.2 Background to the Study

Chemistry as a subject not only by teachers, but also by people keen to learn chemistry, is generally accepted and carried out. The subject gives a greater general knowledge of science, which is mandatory for all individuals who wish to study courses or medicine related to the environment and climate change. In view of the factors that lead to the success of students, numerous research on the quality of schools in general have been carried out. Studies have shown that social, parental and family behaviors adversely affect the performance of learners (Kalu & Ali, 2004; Ajayi, Adewale & Muraina, 2006).

The home and educator involvement in teaching and in the academic and occupational status are some factors that affect achievement. The behavior of students towards the role of science and the home work of teachers are other factors. The study also found that home sites such as urban or rural areas have no impact on the quality of the students. Several studies have stressed that in evaluating student performance at home, variables of context are more critical than those at schools (Hayden & Thompson, 2005).

It cannot be overstated that chemistry plays a role in building a country's science base and Kenya is no exception. The performance of the Kenyan students in the high school field, especially of women, remains a drastic failure with the increasing importance of chemicals for the world. It is misleading to note that, despite the relative importance of chemistry, the quality of students in chemistry during the internal and external exams was considerably low (Saage, 2009). Various factors have been identified to influence the quality of students.

Korau (2006) stated that the student, the educator, community, the infrastructural state, language question, exam-base related variables, curriculum-related variabilities, test-related variables, textbook-related variables and home-related variables were among these factors. Similar variables were described by Saage (2009): weak primary education in science, lack of test opportunities, lack of student interest, students not engaging in hard work, inexperienced primary school teachers, large classes and psychological anxiety.

Chemistry is considered to be a significant branch of science but it has been proved to be a challenging subject to students (Sirhan, 2007). Chemistry is a work that relies heavily on human elements, such as observations, imagination, innovation and competences (Alavi, & Hoseini, 2009). Chemistry is mostly seen as' central science,' because it is essential to master its concept of the structure of matter in all sciences. Essentially, chemistry acts as a gatekeeper to future research in a large number of sciences (Tai, Sadler & Loehr, 2005). As a practical subject, science allows students to engage with the skills of science processes which can be used for solving everyday problems and contribute to national development (Abungu, Okere, & Wachanga, 2014).

The separation between men and women in the scientific community was expected in the primary and secondary rates of achievement patterns (Telli, Brok, & Cakiroglu, 2010). In the typically masculine fields of mathematics and science boys do better than girls in achievement examinations. A significant number of studies record the disparities in sex in science and indicate that men outperform females in science results (Burkam, Lee & Smerdon, 1997). The belief that boys are "by fact" better equipped to succeed in science (Jacobs, 2005) was supported in findings of such discrepancies. These assumptions that naturally show men to be better skilled and more interested in the science influence the ambitions and achievements of men, men and women in science and technology (Furnham, Revees & Budhani, 2002; Kiefer & Sekaqueptew, 2007).

Internationally, scientific achievement patterns in 46 nations indicate that in the United States, among the fourth grade in 2007, men still outperformed women in science with minor discrepancies, although in general, men outperformed women of science in the eighth grade (Mullis, Martin & Foy, 2008). Previously, the National Education Progress Assessment (NAEP) in the United States, completed in 1986, suggested that babies have surpassed the accomplishments of girls in science and sex differences have grown as school children progress. A subsequent NAEP study in 2005 found that men outperformed women in the 4th, 8th and 12th grades in math. Since 1996, women of all levels have achieved relatively little in their average results.

In most examples, physics, chemistry, earth science and space science had the greatest male advantages for grade 11 (Kahle and Meece, 1994). Males obtained considerably higher results in scientific literacy in the final year of secondary school than females in

all participating countries (EU, 2009). In Africa, the situation is no different. The pattern of academic excellence in Uganda, for instance, has shown that boys perform better in chemistry than girls.

Factors based on students ' education and their economic conditions (access and use of learning facilities), socio-economic factors (parent employment, attitudes), school type and the quality of teaching are the factors contributing to a poor performance of students in science have been examined (Kibet *et al*., 2012; Makgato & Mji, 2006; Amukowa, 2013; Mwaba, 2011). There has been research in different subjects such as chemistry, on reasons and factors influencing the academic performance of students (Krätli, 2001). Their results show that there are several causes and factors that impede effective training and subject teaching.

Studies on Obanya's learning features (2010) indicate that cognitive preferences and student performance are positively correlated with those of science (Adeoye and Raimi, 2005). The inspection of schools is important as a mechanism for monitoring the adherence to the curricula and standards of education and ensuring efficiency and quality of education. In addition, “because of the scarcity or the lack of transport, office or office equipment, housing and the willingness of inspectors to take the necessary immediate corrective actions, school inspections were not as successful as planned" (Sarungi 1995). Teachers ' facilities and work environments may also be one of the key factors in preventing or promoting school performance in job satisfaction and teachers ' ability to perform well and effectively.

In a study to determine whether there are gender differences between six senior girls and boys in selected secondary schools in Kampala in the quality of chemical skills, Ssempala (2005) found that although there were no gaps among students in their ability to manipulate the devices and report results, girls had low confidence in their ability, because most assumed that boys are better and similar findings can be seen in Kenya.

In an analysis of the success of students in Kenya Certificate of Secondary Education (KCSE) the Institute for Policy Analysis and Research (IPAR, 2003) reported that the science subjects ' percentage difference in Physics in the four sample districts were 4% in Nakuru, 5% in Kiambu, 8% in Bungoma and 8,7% in Kisumu. In chemistry and biology, the same pattern was observed. It is therefore against this background that the study undertook to investigate the factors that contribute to poor performance in Chemistry by girls in Nandi North Sub-County, Nandi County.

1.3 Statement of the Problem

Performance in science and chemistry quality in particular has long been at the core of science. Although the main focus was to differentiate girls and boys, the great volume of the study was attributed to the apparently low performance of science students compared with other subjects. Chemistry took the bottom positions of 13out of 15 subjects and 14 out of 16 subjects in 2012 and 2013 respectively.

Performance in Chemistry has declined from 4.2973 to 3.9573 between the years 2012 and 2013. The performance, though was not good at first continues to deteriorate and this is worrying. Sub average performance in Chemistry affects the Sub County's ability to admit students in universities in courses to do with science and technology. In the county,

most of the students take Chemistry and therefore poor performance in the subject affects their social mobility. This is despite the fact that the government has put in measures to improve performance in the subject through launching the Strengthening of Mathematics and Science in Secondary Education (SMASSE), in 1998 that aims at improving mathematics and science education through In-Service Training (INSET) for teachers.

Factors that could lead to this are Instructional resources, Teaching method, Teacher's motivation and Learner's academic ability. It has been noted that the performance of girls in chemistry has been lower in Nandi North sub county. The study therefore investigated the factors contributing to this poor performance in Chemistry among girls in public secondary schools in Nandi North Sub-County, Nandi County, Kenya.

1.4 Purpose of the Study

1.4.1 General objective

The main purpose of this study is to determine the factors influencing the performance of girls in chemistry subject in secondary schools in Nandi North Sub-County, Nandi County, Kenya.

1.4.2 Specific objectives of the Study

From the literature, many factors have been mentioned influence the performance of girls in chemistry subject in secondary schools but the study was guided by the following specific objectives.

i. To investigate the attitude of girls towards learning of Chemistry
ii. To establish the effects of teacher interaction styles on secondary school students' achievement in Chemistry in Nandi North Sub-County.

iii. To determine the extent of influence of availability of teaching/learning materials on secondary school students' achievement in Chemistry

iv. To investigate the perception of teachers towards teaching of Chemistry in secondary schools.

1.5 Research Questions

The following were the research questions of this study

i. What is the attitude of girls towards learning of Chemistry in secondary schools?

ii. To what extent do teacher interaction styles influence chemistry achievement in secondary schools in Nandi North Sub-County?

iii. To what extent does availability of teaching/learning materials influence secondary school students' achievement in Chemistry

iv. What is the perception of teachers towards teaching of Chemistry in secondary schools?

1.6 Justification of the Study

Performance in Sciences in National examinations particularly in Chemistry has been poor especially among the female candidates. It has been noted that boys usually perform better than girls and therefore there has been focus on differential performance of girls and boys. This study has been necessitated by the apparent low performance by girls in Chemistry compared to boys.

1.7 Significance of the Study

The results of the study may provide a framework for teachers to reassess their educational strategies for the improvement of effective education and learning in chemical lessons. It could also provide the curriculum developers insight into the kind of

practical experience needed to provide sound insight into scientific concepts and values in high school chemistry. Further the study findings could provide a framework for the Kenya National Examination Council (KNEC) on which it could re-evaluate their objectives and objectives so that the practices during secondary school Chemistry lessons especially practicals are in line with the curriculum demand of students.

1.8 Assumptions of the Study

The study was based on the following assumptions.

i. Boys and girls have the same cognitive ability
ii. Form three students have enough experience in school and could make appropriate evaluation about themselves
iii. The influence of non-teacher inputs on attitude and achievement is constant.

1.9 Scope and Limitations of the Study

1.9.1 Scope of the Study

The research has been performed in selected Nandi County, Nandi County, Kenya Secondary Schools. Three students and chemistry professors from chosen schools were the study's respondents. Form 3 students were favored because they had experienced a variety of teaching strategies and had experience during their primary education. The study examined factors that influence girl's success in chemistry in high schools. The research took place from May to June 2017.

1.9.2 Limitations of the Study

The following were the limitations of this study;

i. Descriptive survey design was used and therefore the influence of time-change was not captured.

ii. The study was limited to the sampled schools in Nandi North Sub-County and therefore the study findings may not be applicable to other secondary schools in other parts of the country.

1.10 Theoretical and Conceptual Framework

This section presents both the conceptual and theoretical frameworks which guided the study.

1.10.1 Theoretical Framework

The current study was based on Cognitive Load Theory by Anthony and Artino, (2008). The Learner theory shows, "Learner cognition influence the motivation of the learner (Anthony & Artino, 2008). It is considered as the key to the academic achievement of the learner in this report, since it decides the learning's progress. Evidence has shown that students have different styles of cognition. To order for the instructor to work on particular tasks or situations, he must be able to develop the technique by means of cognitive techniques (Danili & Reid, 2006).

Teaching and learning are relations between the student and a teacher's curriculum (Fosnot, 1993). The Cognitive Load Theory describes the teacher's methods and discusses the students ' different cognitive capacity. Therefore, teachers must use various educational strategies in chemistry to improve student performance in this subject. Cognitive loads are the components that must be handled by the working memory in a time example (Kirschner, Kirschner & Paas, 2009). A small number of new elements can be processed and stored only by the working memory (Anthony & Artino, 2008; Merrienboer & Sweller, 2005, Kirschner et al., 2009). The ability of the working memory

to process and store new information in schemes to make room for new data is a measure of good learning (Anthony & Artino, 2008).

The theory of cognitive loading suggests that cognitive load should not surpass the workforce (Anthony & Artino, 2008; Kirschner et al., 2009).). It also provides ways of controlling mental stress and developing learning systems (Kirschner et al., 2009). By practice, educational materials are in line with a lesser person's intellectual abilities (Cook 2006). Whatever a student is taught, he / she must have a little working memory, which is ingrained in an infinite and later stage long-term memory (Cook, 2006; Kirschner et al., 2009).

It is based on schemes (Kirschner et al., 2009) that the data can be stored and structured in the longer memory. If the schemes are built properly, a student may research the subject. Sweller (1994) supports this point, where he says "the intellectual control of any topic depends on acquisitions of schemes and the transfer of learned methods that range from controlled to automated processing." In this study, use of various instructional resources including textbooks and laboratories enables learners to master the chemistry concepts thus enhancing their performance in the subject.

1.10.2 Conceptual framework

Figure 1 shows that some of the factors selected (independent variables) that affect the performance of children in high school chemistry (dependent variables). School considerations and previous experience of students were the key variables in this analysis. These considerations have been incorporated into the development of the

principal instruments for data collection to mitigate their effects on the results of the study.

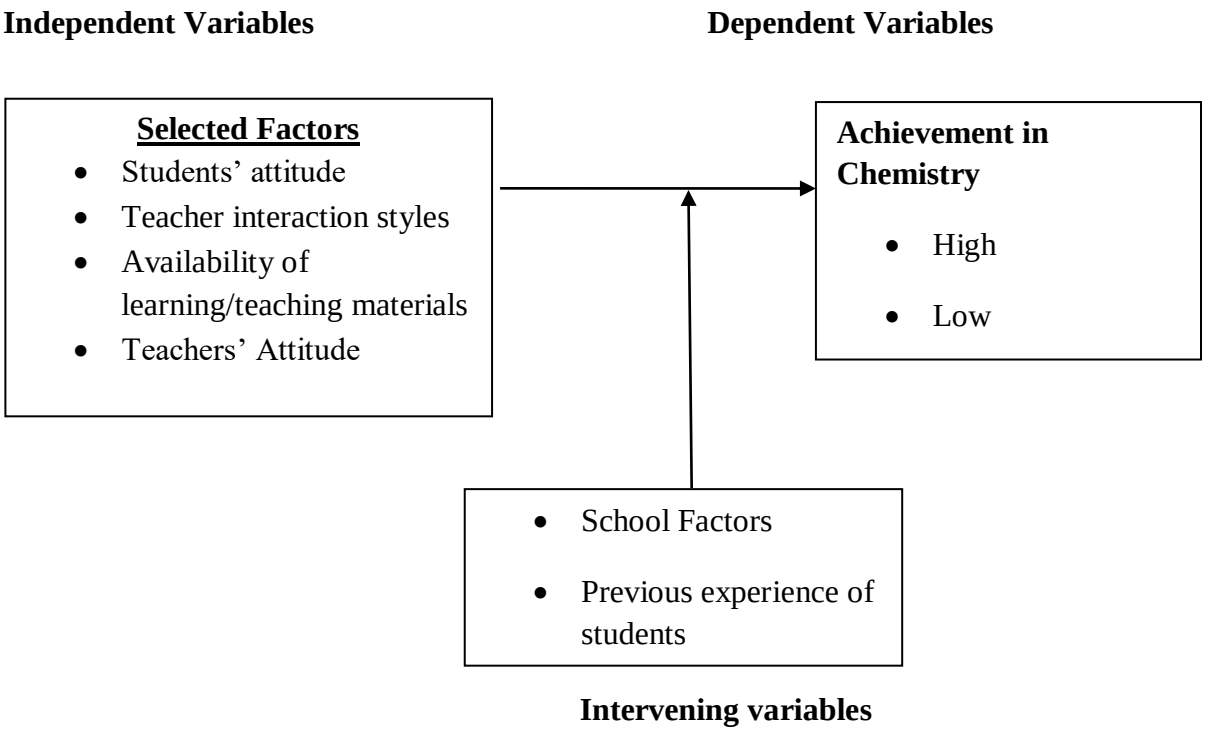

Figure 1: Conceptual Framework on factors influencing the performance of girls in Chemistry subject
(Source: Author, 2017)

1.11 Definition of Operational Terms

Achievement: Refers to learners' outcomes in Chemistry through tireless efforts by both the teachers and learners.

Attitude: Refers to student/teacher disposition to act in a particular way in relation to Chemistry education.

Chemistry: One of the science subjects which is concerned with the study of matter and its transformation through such processes as heating, electrolysis and other Chemical processes.

Factors: Variables that could contribute to students' performance in Chemistry. In this study, these variables could include student variables, teacher variables and school related variables

Influence: The ability to have the power to affect something in a given way

Interaction styles: Refers to the communicating methods employed by teachers in teaching students during Chemistry lessons.

1.12 Summary of the Chapter

This chapter has dwelt on background to the study, statement of the problem, purpose of the study, objective and research questions, justification and significance of the study, assumption, scope and limitation of the study. It also has conceptual framework and definition of key terms. The next chapter deals with the review of literature in line with the topic and research objectives.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter deals with the general review of literature on factors that influence students' achievement in Chemistry. The section covers factors influencing girls' achievement in chemistry, attitude of girls towards chemistry, effect of teacher interaction styles on girls' performance in chemistry and effect of teaching and learning materials on students' achievement in chemistry. The teaching and learning materials of great focus were chemistry laboratories, books, adequacy of teachers and school infrastructure. In addition, the chapter covers teachers' attitude towards teaching of chemistry and lastly the summary of the literature provided.

2.2 Factors Influencing Girls' Achievement in Chemistry

Chemistry learning restructuring is being undertaken in most countries worldwide. The main reason for this change is that the status of most chemistry curriculums, including an alienation from the individual interests of students, current social and technological problems, and the modernity of chemistry itself, is increasingly discontinuous (Jong, 2006). Holbrook (2005) noted that focus on knowing concepts and the appreciation of the nature of science seems insignificant to the usability of human life which demonstrates home relevance, environmental relevance, possible jobs and, most importantly, future change and changes in society.

However, Sirhan (2007) observed that learners tend to be more interested in problems that have a obvious impact on their own lives, embedded in difficult real-world contexts.

If these problems are important, interesting, or involving students, they can be inspired automatically. This therefore shows that motivation to learn is a significant predictor affecting the achievement of learning meaning that teachers are faced with challenges particularly when learners are not motivated to learn specific subjects such as chemistry (Sirhan, 2007). This argument is further supported by Akbas and Kan (2007) who noted that the effects of affective characteristics of learners on specific lessons in school education have been established through various studies which have been undertaken.

Due to the fact that the academic success is closely associated either indirectly or directly with various predictors, the affective predictors need to be considered as one of the predictors. With high degree of reliability, the predictors which include anxiety and motivation are deemed to be affecting other predictors including the choice and the interests of learners in specific subjects. Therefore, it can be assumed that learners' achievement and their academic performance would be greatly affected. Studies by Banye (2005) pointed out that students' attitude toward science affects behaviours like selection of courses, visits to museum or the continuance with learning of science.

Additionally, in a review, Berg (2005) found that a positive change in interpretation was closely linked to evidence of distressed behaviour, whereas the negative change was associated with less motivated behaviour. In schools where students with positive changes in attitude had less negative views of school variables, while students with unfavorable change in attitude displayed a different pattern. Learners were also debating similar predictors in schools. Since factors were the same, the perceived empathy of learners in teaching for their efforts in the field of chemistry seemed to affect both

groups, indicating that changes in their institutional environment are considered beneficial to all learners.

Jurisevic et al. (2008) further found out that students are motivated more or less equally to study chemistry in relation to any other subject, but that the motivation fundamentally falls as a result of an obstacle to a particular course in chemistry and mathematics. It was also found that students with low motivation to research symbolic concepts were of three degrees of chemistry-namely, macroscopic, submicroscopic and symbolic. The relationship between inspiration rate and the results of the tests of knowledge were found to be low but statistically significant, while the motivation to mark relationship was achieved in chemistry was found to be statistically not significant.

Akbas and Kan (2007) also said that while second grade students are expected to receive the highest degree of encouragement from chemistry, 1st grade students are worst nervous about the chemistry course. The motivation and anxiety of the chemical object itself, however, was found to be a significant indicator of the chemical sector's achievements. Excessive stress disorder affects the training and success of students. Jurisevic et al. (2008) concluded in their study that university and school students were equally motivated to learn, particularly in the fields of physics and chemistry.

In their study called' Corelationships from the observed attitude toward studying Chemistry ' Anders and Berg (2004) attempted to classify such associations or predictors between university students in Sweden. The result of the study showed a more positive change in the attitude of highly motivated students of chemistry education. Nevertheless,

the current study explored girls ' approach to chemical education in Nandi North County, Kenya, public high schools.

Previous stories have shown that important predictors are subject to three categories: demographic, general structural, and prior scientific training. Demographic characteristics and the general faculty are known to forecast social circumstances whereas the impact of high school teachers is beyond previous academic performance and student interest (Tai et al. 2005). Therefore, the teacher must understand what the students learn and how they gained the knowledge (Sirhan 2007). It is important to know what they are learning. Tai et al (2005) reports that the discovery of pedagogical practices in classrooms that correlate with subsequent successful science education and suggest that there may be an important connection between science teaching in secondary schools and successful scientific study in colleges in the enhancement of students ' performance in science courses. Both the traits of students and their high school learning experiences are related to these factors.

Tai et al., (2005) suggested that teaching chemistry in high schools has an effect on university chemistry results. 24 experiments performed before 1967 were reviewed and concluded that there was some evidence about the use of high school chemistry as a predictor of career and university success. In mathematics, high levels of place, and outcomes of performance tests, intellect and gender, there is evidence of enhanced or at least as good experiences. There is also proof that there is no good indicator. This research has therefore explored factors affecting girls ' success in chemistry in Nandi North Sub-County, Kenya, public secondary schools.

2.3 Attitude of Girls towards Learning of Chemistry

Attitude is a concept or consideration based on a particular circumstance, according to Abudu or Gbadamosi (2014), that can predict whether an individual wants or doesn't like a certain object. In addition, they have classified the behavior as positive, negative or neutral in three specific categories. Their work considers the attitude towards science as an essential indicator, the influence the performances and views of students on the subject.

It has been shown that only a positive attitude can lead better achievements amongst learners in sciences since a positive attitude is associated with learners' interest in the subject which in turn leads to commitment which translates to learners' yearning for better academic performances (Simon & Collins, 2003). These researchers in their study in the UK pointed out that students enrolling for sciences in high schools had a more positive attitude towards sciences. However, the de-contextualized nature of the school science curriculum leads to students having a negative perception towards school science.

Previous studies have shown that knowledge is closely linked to the academic achievement of students. For example, the meta-analytical survey carried out by Weinburgh (1995) has shown that 0,50 for male students and 0,55 for female students are the relationship between perceptions of science and performance. This showed clearly that the difference in performance alone accounts for between 25 to 30 percent. In addition, Freedman (1997) found that the correlation between science attitude and achievement is 0.41 in the treatment group, while using a post-test only control group model.

However, in her research, Salta and Tzougraki (2003) indicated that their expectations of chemistry ranged from 0.24 to 0.41 in relation to the achievement of secondary school students in chemistry. In a similar survey, the graduate students Bennett, Rollnick, Green and White (2001) found that they almost always got a lower test mark when they had a less positive attitude to chemistry. This therefore demonstrates that the attitude of the students towards chemistry can correlate with their performance in this field.

Attitudes predict behaviors, according to Glasman and Albarracín (2006). Kelly (1988) considered British students ' preference for a specific topic in physics, chemistry, or biology in schools to be a good predictor of their actual choice. Research has also shown that students have various physical, chemistry and biological attitudes at school (Barnes *et al.,* 2005; Murphy & Whitelegg 2006; Osborne & Collins 2001; Spaull *et al*., 2013). Girls tend to respond more positively to biological sciences than to physical sciences (Warrington & Younger, 2000).

The student's problems in chemical course, the interest in chemistry course, the significance of chemistry for students future career, and the relevance of chemical studies for students lives did not show any discrepancies between gender attitudes regarding integer attitudes in another study, Salta & Tzougrak (2003), in a survey of 576 students in the Greek high school while using an attitude scale of four subscales.

Chang, Yeung and Cheng (2009) studied ninth graders' learning interests, life experiences and attitudes towards science and technology. A total of 942 urban ninth graders in Taiwan were involved in the study. Pearson correlation was used for data analysis. The results showed that the interests of young men in sustainable development

and science topics are higher than those of women. Women, however, remembered more science and technology experiences than men. However, the results showed a high correlation in the context of attitudes towards technology between learning preferences and living experiences in science and technology.

Given its important potential in learning chemistry, its importance to the human race and researchers ' efforts to improve the quality of their teaching and learning, especially in secondary schools, student performance in the subject in public exams in recent times is disappointing (WAEC Chief Examiner's report, 2010). The objectives of chemistry training and science may not be accomplished unless this tendency is overthrown. The failure of the student in Sciences and especially Chemistry at SSCE confirms the lack of effective Chemistry Learning.

This indicates that the requisite skills were not acquired as learners could be exposed to laboratory activities due to inadequacies. It is an example of a lack of research and education in the process of teaching and learning in chemistry in high schools. As chemistry is an experimental science, it should be taught in a well-designed laboratory learning environment through an activity-based approach. Azizoglu and Uzuntiryaki (2006) stated that laboratories need to improve student understanding and knowledge of scientist concepts and scientific processes to develop interest, curiosity and good attitudes towards chemistry, creativity and problem solving.

Research on sex have shown that attitudes towards science education vary between boys and girls. Jacobs (2005) cited in Banye (2005) found a reduced interest in chemistry and the underrepresentation of women in chemistry. Academic confidence in chemistry, role

models and the knowledge of the importance of the effects of chemistry, according to Banye (2005), on young students ' decision to study chemistry. In young women who study chemistry, self-confidence is diminished, and consequently attitudes to chemistry differ. The studies conducted and the suggestions made by young women in science and chemistry are even more negative than positive. The study thus examined the stance of girls in high school in Nandi North Sub-County, Kenya, towards the chemistry subject.

2.4 Effect of Teacher Interaction Styles on Girls' Performance in Chemistry

The way a lesson is given defines its usefulness and the degree to which the students are taught (Mwenda, Gitaari, Nyaga, Muthaa & Reche, 2013). A study by Too (2004) on effective mathematics instruction looked at classroom instructional processes and its attendant students' activity. He examined three main aspects of classroom discourse namely: Teacher interaction with students through questioning, teacher supervision of class tasks and individual learner activities for example, variety of ways in which students worked or engaged in mathematics tasks. The study findings indicated that mathematics teachers spend a rather disproportion amount of time providing information at the expense of other more important teaching strategies like providing feedback, praising student efforts and promoting tension free environment.

In a study by, Muhenge (2007) the researcher identified seven variables that were deemed to affect effective teaching and learning in a typical classroom setup. These classroom variables include engaging learners in authentic and multidisciplinary tasks, assessing students based on their performance of real tasks, enabling learners to participate in interactive modes of instruction, allowing learners to work collaboratively, grouping

students heterogeneously, teachers acting as facilitators in learning and encouraging students to learn through exploration.

Muhenge (2007) categorized teaching methods into two; conventional, traditional, dominative, teacher centered or direct methods and innovative/ integrative/ child-centered or indirect methods. He explained that conventional methods are teacher-centered with a lot of emphasis on the content. The teacher verbally articulates content greatly using the chalkboard to set out important points and give students' notes while students listen, write down notes and occasionally participate verbally by responding to the teacher's questions while on the other hand, innovative (indirect methods) are child- centered. The teacher helps the learner to find out by posing questions, guiding, indicating sources of information and sharing ideas, problems and solutions.

A study by Motani and Garg (2002) suggested that a successful learning setting allows for simple and continuous communication between students and teachers without inhibitions. Student education is not left to chance in such a learning environment but teachers know whether or not their students understand the concepts intended. The secret to this progress is the introduction and use of an immediate feedback system, which enables educators to interfere quickly when a concept or idea is misunderstood which is necessary to achieve the learning objectives.

An educator may need to change a learning approach in this process, provide various examples or provide alternative explanations. In making these changes, teachers show that they recognize and appreciate the ineffectiveness of previous efforts to teach a concept or principle. Additionally, allowing rapid teaching changes to meet students and,

in general, less effective students, results in better learning for all students (Guskey, 2003).

Unlike the Piagetian, Vygotsky claimed that the concept had been better built together with another cohabitant, professor and parent (Banye, 2005). In high schools or other schools, chemical methods must be used effectively (Holbrook 2005). It is also necessary to discuss the importance of the chemical industry. In a 2007 study by Sirhan, aspirations and motivation are both key elements of the process of learning in which success is closely related to positive attitudes and motivation for learning.

Teacher quality and curriculum quality are the two principal predictors that affect attitudes towards a subject. The most significant influence on choice in terms of instructional strategies was a result of professor's knowledge, beliefs and experience, which influenced 90% of lessons that teachers taught in the study, according to a study conducted by Weissai et al (2003) with 6.1 U.S. high school teachers being interviewed and observed.

The methods of teaching employed by a chemistry teacher in Karr, Makher and Son (2006) are based on the student's understanding of the process. A teacher makes a big effort to make his or her students grasp the concepts and strives to include the students in the learning process so that they can recognize that the students can replicate science and chemistry purposes. Teachers want students to learn and use what they have learned in the future.

The study by Wakanga and Mwangi (2004) on the impact on secondary school educational achievement of secondary students in Nakuru County of the Cooperative Class Experiment (CCE) study found that CCE promoted learning chemistry. However, in contrast with other teaching methods, gender had no impact on learners ' achievement. The study also revealed that the type of school attended did not have a big impact on the educational performance of girls when CCE was used, but it was successful and better in terms of the achievement of the boys.

Recent Baird and Mitchell research (1986) in the eighties have proposed that better methods of learning could be promoted by professors of chemistry. Such learning approaches allow students to achieve effective and understanding learning. Better learning styles increase the accountability and success of students for their own education. This research aimed to define the kinds of communication types widely used in secondary school chemistry in Nandi North Sub-County students.

2.5 Effect of Teaching and Learning Materials on Students' Achievement in Chemistry

This section presents the effects of various teaching and learning materials on learners' performance in chemistry in public secondary schools.

2.5.1 Laboratories

Wong and Fraser's early studies (1996) found a significant link between the essence of the chemical laboratory environment in the classroom and the results of the students. Similarly, Tai et al. (2005) discovered a number of interesting pedagogical perceptions in high-schools, that seems to be correlated with various laboratories of comprehension.

While over-emphasis on laboratory chemistry in high school was correlated with the lower levels at university, these results indicated that the pedagogical choices of secondary school teachers were associated with future acquirements. Learners who reported higher instances of repeating labs to enhance their understanding improved their chemistry grades than their peers who reported less or no instances of repeating laboratory work for understanding. The researchers pointed out that laboratory work holds greater promise in helping to prepare secondary school learners for college-level studies.

The school lab is an important tool for teaching and learning chemistry, as it gives students a large number of special equipment. A high degree of preparation on the part of students is needed to use the entire chemical laboratory equipment. It is important to make efforts by instructors at this point to use the latest teaching techniques to improve performance and to promote learners ' interest in chemistry. Researchers including Adeyemi, (2008) Arokoyu and Ugonwa, (2012) amongst others have reported that inadequate laboratory equipment and learner-centered behaviors towards the subject which we view as challenging and inefficient teaching strategies, are responsible for this unstable quality in the topic. This is the consequence.

Earlier Adeyegbe (1997) attributed the inability of teachers to attend student laboratory practical sessions to the poor performance of practical chemicals learners. Ikeobi (1996) also noted that there are numerous cases in which the students could not decide the titles of volumetric analyzes because the titles are very different from the instructors. Adeyemi

(2008) has also found that insufficient supplies of science labs and facilities in many secondary schools have affected the quality of students in chemistry.

The learning standards must be reexamined to resolve the challenges associated with the poor performance of students in the area of chemistry education and learning. These reviews should focus on determining the impact of laboratory learning on student learning outcomes. A student-friendly learning environment helps students to take over their learning processes, thus rising learning results (Adeyemi 2008). The inadequacy of laboratory learning environments at school level that indicate poor performance in chemistry and other similar subjects.

2.5.2 Staff Availability and Utilization

Recent documents show that South Africa continues to face various obstacles for science teachers, largely because every year science teachers leave the education sector (Modisaotsile, 2012). This is due to low wages, inadequate infrastructure and resources in schools and an excess of the workload of teachers (Hughes, 2012). The South African Educators Council (SACE), 2010 confirms and adds that there are also science teachers who are exempted from the Ministry of Education due to a lack of career progression among secondary teachers.

The retirement of seasoned chemistry teachers, as Hughes pointed out, (2012) is another issue that has been recognized. This phenomenon has contributed to the shortage of science and mathematics instructors and the recruitment of under-qualified technical teachers in South Africa (SACE, 2010), respectively (Naidoo & Benson, 2010). The SACE (2010) adds that there is a problem of reliability of science education and teaching

methods where there are science teachers. This is perceived to be an ongoing challenge as fewer students are also prepared to study science (Dhurumraj, 2013).

Spaull (2013) also pointed out that statistically, the enrollment in mathematics of students in South Africa declined from 56% to 45% between 2008 and 2011. On the basis of research that is focused on low levels of enrolment in STD and under-skilled educators, student insight into the STD and content awareness can be a factor in the poor performance of students in science, because performance is affected by student insight in STD (Hughes, 2012).

If good performance is to be achieved in line with the Republic of Kenya's recommendations (RoK, 2005), there should be the best use of the teachers available. Later Ngala (1997) said that school principals tend to blame this fact for the poor performance of teachers where they are scarce. Fonseca and Conboy (2006) nevertheless say that a culture of performance may either be encouraged or hindered by the physical circumstances and organization of schools. The researchers noted the value of sensible laboratory conditions and even class decorations for enhancing the participation and achievement of learners in the sciences.

They argue that positive images of science can be difficult with news, posters, storytelling, video presentations, projects and prizes that demonstrate that science is feasible. As quoted at Ngala in 1978, effective teaching papers, as well as the allocation of time and resources for managers in effective schools, teachers and leaders were organized, arranged, investigated and prepared.

Moreover, Boyd and Barbarin, (2008) pointed out that teacher adequacy compromises the quality of education and therefore in order to identify the adequacy of teachers in a school, the learner-teacher ratio (STR) needs to be established. STR will inform on the adequacy of teachers in an institution thus necessitating action among education planners. The downside of a low STR is that there are fewer students in the classroom to attend to by an educator. This ensures a good academic performance and the teacher pays attention to the students.

Low STR means, on the other hand, that an educator should deal with a large number of students concurrently in the classroom. The relocation of teachers from schools without replacements is impacting students ' academic performance, which results in inadequate teachers affecting the teacher-student ratio (Wanyama, 2013). Several scholars have carried out studies with an aim of addressing the predictors affecting academic performance in KCSE among secondary school students in Kenya.

In Trans Nzoia West Sub County Simiyu (2013) studied factors influencing the university performance of students in public secondary schools and learned that factors related to schools greatly contributed to academic performance. For example, Simiyu (2013) The research also found that there is a rich library, relevant textbooks, well-trained teachers and spacious classrooms. The study also shows that almost half of the heads of schools rarely take a look at teacher's professional records.

Rosehotz and Simpson (2002) claim that the current educational theory assumes that the failure to employ sufficient and qualified teachers is one of the main causes of the wavering growth in many countries. Tyke and O'Brien also argued (2002) that the

number of schools enrolled in schools, the turnover of teachers and retireing schools was overwhelmed by the lack of professors, which, in effect, led to poor university results. Insufficiency of teachers in most secondary schools worldwide in Kenya is considered to be a problem.

Klaus and Dolton (2008) noticed a similar situation in Australia, arguing that the country needs a minimum of one million teachers in the following ten years as the failure could affect the academic performance of students. The loss of both new and experienced teachers posed a problem to schools and school administrators throughout the United States, it turned out in a similar study by MacDonald (2007). This is also known to influence the academic performance of students. According to Tyke and O'Brien (2002), most educational institutions around the world have been forced to lower educational standards by hiring unskilled teachers to fill the gap, thus lowering the school's academic performance.

2.6 Teachers' Attitude towards Teaching of Chemistry

Learning is an activity that helps students gain and improve their character while they prepare them to live in society for the necessary knowledge, ability, attitude and understanding. The research fields are influenced by two concepts: the reading and the learning. The learning theory, says Karsli (2007). Teaching also means the improvement of a student's abilities which usually can be accomplished in proportion to his or her ability to retain them during the training stage. Learning and teaching is the most important factor.

An educator is thus supposed to be an instructional worker who helps learners to achieve cognitive, sensory and behavioral objectives within the scope that the education system has developed (Gundogdu & Silman, 2007). There are also good interactions between the teacher and his or her pupils and can be more effective in communicating them to students when an instructor recognizes that the nature of knowledge and skills is a direct influence to their learners and environments (Ari 2008). In addition, lessons improve the motivation and performance of students by being able to interact with the learner and show positive actions such as questions, knowing their feelings and showing interest and appreciation.

When students work to provide knowledge, expertise, and actions on a particular subject at a certain stage, teachers may turn their behavior and attitudes into role models for their students. In fact, a positive attitude is correlated with performance, while a negative attitude is associated with failure and can result in positive attitudes towards the ego when failing results in negative behavior towards the ego. For example, Gecer (2002) says that if a teacher comments negatively on a teacher's achievement, negative consequences are unavoidable. The quality of the class is not entirely due to its practice, but is affected by several factors, and the first is the teacher's attitude towards the teacher. A positive teacher attitude is related to the motivation of the student, its attitude towards school and college, its self-confidence, and thus to the development of a personality.

Accordingly, teaching does not tell or describes the principles. Gundogdu and Silman, (2007). The students ' encouragement from educators and instructors, who communicate and put forth their constructive intention to inspire the student to learn is one of the

fundamental philosophies of teaching skills (Yavuzer, 2000). Although the teacher's positive action helps him to create a positive relationship with learners, it also allows the teacher to analyze the positive conduct of students in contrast with the negative and also to take on a strengthening role (Yavuzer, 2000).

Factors including educators, attitudes and teaching methods can affect the environment of the students towards learning to a large extent according to Yara (2009). However, Bennett et al. (2001) stated that undergraduates with a lower positive conduct towards chemistry were almost always tested with a low degree. Several factors related to the student's attitude to chemistry have been identified: methods of teaching, teacher's attitude, influence of parents, gender, age, student's cognitive style, career interests and social involvement in chemical science and achievement have been included (Adesoji, 2008).

A hypothesis that teachers who are taught the right approach or actions can attain higher levels, as their teachers have exhibited the correct attitude and gained the skills to manage different types of class challenges, is a common one in terms of teacher behavior and learner achievement (Evans 1992; Gibbons et al. 1997). Therefore, the best way to teach students with different skills, prior knowledge and history is to focus on experienced teachers (Rauden & Williams, 1991) on the most suitable way to teach them unique topics. The present study thus explored the results of the attitudes of chemistry teachers to teach girls at Nandi North Sub-County public high schools.

2.7 Summary of Literature Reviewed

Many factors have been shown, especially in girls ' chemistry, to influence student performance. Inadequate laboratory equipment for chemical research (Eniayeju, 2010)

bad teachings (Ayogu, 2001) and the mathematical character of chemistry are some of these factors mentioned in literature. among other things. Research has shown that girls outperform boys in chemistry (Gibb, Fergusson et al., 2011).

Nevertheless, among other scholars, Awofala (2011) and Oluwagbohunmi (2014) revealed that they performed better than girls in the matter. This research was necessary due to contradictions in literature and poor performance of girls in chemistry in Nandi North Sub-County. The results for the Nandi County girls ' schools for the years 2010, 2011, 2012 and 2013 were 4.5, 4.6, 5.3 and 4.9 and therefore the factors contributed to girls ' poor performance in this subject had to be investigated.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter deals with how the data for the study were obtained and analyzed. It consists of a description of area of study, research design and methodology, study population, sampling procedures, research instruments, validity and reliability of the instruments, data collection procedures, analysis and the ethical considerations that were adhered to.

3.2 Study Area

The research took place in the Nandi north sub-county, Nandi County, Kenye, among students and chemical teachers in selected secondary schools. Nandi North is one of the six Nandi district divisions that surround northern and eastern Uasin-Gishu District, west Kakamega County, and south of Emgwen County. The research area map is shown in Appendix iv.

3.3 Research Design

Creswell (2009) describes research designs as plans and study procedures covering decisions ranging from general theories to detailed data collection and evaluation methods. This research used the descriptive format of the survey. Descriptive survey structure provided for a summary of the situation as it was and the results published (Kombo & Tromp, 2009). Kothari (2008) notes that such development represents an efficient means of gathering descriptive information on population characteristics to explain present conditions and practices.

3.4 Research Methodology

This study adopted the use of mixed methodology where both quantitative and qualitative data collection and analysis approaches were used.

3.4.1 Quantitative Approach

Quantitative research is known as a deductive analysis technique (Rovai et al. 2014). The universe has been seen as outside of itself by empirical scholars and as "an objective, independent fact of all observations." The authors argue that this fact can be clarified by subdividing it into smaller, manageable sections for analysis. Such smaller subdivisions allow for analyses and for the tests and replication of hypotheses about the relationships between variables.

This method is characterized by the investigator proposing a theory, expressed in a particular hypothesis, then tested and inferred from a set of observations and analysis of data in accordance with this hypothesis (Rovai et al., 2014). In this study quantitative data were obtained through the use of questionnaires and analyzed by use of frequencies, percentages and Pearson Correlation Coefficient.

3.4.2 Qualitative Approach

Qualitative research focus is to examine and understand "the importance of social or human issue for individuals or groups" (Creswell 2014). This approach is defined by Denzin and Lincoln (2005) as having a view of issues by analyzing them in their own specific context and of the importance that people bring to them. It is about drawing meaning from participants ' perceptions and views that it determines sense, intent, or fact (Cohen et al., 2007; Merriam, 2009). Qualitative approaches are often defined as inductive, based on the assumption that reality is a

social structure, variables that are difficult to measure, complex and interwoven, the primacy of the subject matter and the data collected consist of the viewpoint of the insider (Rovai et al., 2014).

Rovai et al. (2014) stress that this"... values individuality, culture and social justice" approach to research provides an information-rich content and context, which is present, albeit in the subjective nature (Tracy, 2013). That said, the use of qualitative approach approaches has shown that the implementation of a critical, structured and fair research on any academic subject is not prevented (Thomas et al. 2011; Silverman 2009; Bell 2010). In this study the qualitative data of chemistry teachers interviews were collected and subsequently data were transcribed, categorized thematically and organized before narratives and quotations were published.

3.4.3 Mixed Methods Approach

The research followed mixed methods that integrated both quantitative and qualitative approaches in the theoretical hypotheses. This means that both kinds of data are collected and analyzed, but also that both approaches are used in conjunction with the study to achieve a higher overall strength than any of the two approaches (Creswell, 2009). The combination of quantitative and qualitative methods, according to Creswell and Clark (2011), provides a better interpretation of research issues than either approach alone. Mixed approach is the corner stone of social science research that is performed daily (Creswell & Clark, 2011; Johnson & Onwuegbuzie, 2006).

A' third theoretical trend' (Teddlie & Tashakkori, 2009) and involves a' fourth, quantitative or qualitative approach' (Morse & Niehaus, 2016), is defined as the' third paradigm' (Johnson & Onwuegbuzie, 2006). The investigators are no longer limited to certain paradigms that have historically existed and are treated as a legitimate means of research in the field of social and human sciences (Creswell & Clark, 2011).

The combination of methods allows the researchers to design questions in the context and parameters of their research using different approaches (Johnson & Onwuegbuzie 2006). Bernard (2014) adds that the explosion of collaborative and creative research across disciplines has resulted from mixed methodology. This helps tackle broader issues that provide a more accessible and innovative research approach (Johnson & Onwuegbuzie, 2006).

The combined methodology approach incorporates a multi-level approach that incorporates a two-phase approach, in which quantitative research is first carried out and qualitative research is followed (Flick, 2011). The quantitative data include general patterns and length, and qualitative data represent the experience and scope (Newby, 2014). Each stage can be converted into a third phase. The effects of qualitative data also lead to contextualizing and enriching information (Bryman, 2004, Mason 2006), to making data more reliable (Orgard, 2005) and to the creation of new insights (Stange, 2006). Mixed methods can contribute to a deeper understanding of the topic area (Hoover & Krishnamurti, 2010). It can help increase confidence in the findings, provide more proof and account for potential

shortcomings by using a single method (Caruth, 2013; Creswell & Clark, 2011; Tashakkori &Creswell, 2008).

3.5 Target Population

A population is the whole group of people, events or objects with specific observable features. The population to which a researcher wants the results of a survey to be generalized is a target population (Kothari, 2008). The target population for this study was Form three students and Chemistry teachers in Nandi North Sub-County secondary schools.

The Sub-County had 42 secondary schools with 42 Form three Chemistry teachers and 1563 students which formed the target population of this study. Form three students were preferred because they had three years post primary learning experience and as such they had been exposed to variety of teaching strategies/ experiences. Form fours were not selected to participate in the study since it was considered as an examination class and therefore needed no disturbances.

3.6 Sampling Procedures and Sample Size

Sampling is a process used for the selection and analysis of part of the population (Maree, 2007). This ensures that a researcher is chosen to be in the best position to provide the necessary information needed for a particular study, according to the student. For the whole population, any statements made about the sample must apply. Factors such as costs, time and availability frequently prohibit researchers from obtaining information from the entire public, as Cohen, Manion and Morrison (2007) have suggested. Evidence from a smaller group or sub-group of the total

population must therefore be gathered in such a way that the knowledge gained is representative of the overall studied population. The sampling method for this study is given in this field.

3.6.1 Sample Size Determination

The sample size for this study was determined using sample size determination formula advanced by Krejcie and Morgan (1970) as quoted by Kasomo (2001). The formula is given as:

$$\mathrm{n} = \frac{X^2 * N * P(1-P)}{\left(ME^2 * (N-1)\right) + (X^2 * P * (1-P))}$$

Where:

n= Sample size

X^2 = Chi-square for the specified confidence level at 1 degree of freedom

N= population size

P = population proportion

ME = Desired Margin of Error (expressed as a proportion)

Using the formula, the sample size for a target of 1563 students at a confidence level of 95% was 303 students.

From a target population of 42 teachers of chemistry, thirty percent (30%) were selected by simple random sampling technique to get a sample size of 13 teachers. The choice of 30% is based on the recommendation by Mugenda and Mugenda (2003). The recommendation is used to determine the size of a randomly chosen sample from a given finite population such that the sample is within + 0.05 of the population with a 95% level of confidence.

3.6.2 Sampling Procedures

In selecting students to participate in the study; secondary schools were stratified by gender into; single gender and mixed schools. After stratification, in relation to the population size of each school 303 students have been identified using a simple, random sample technique. Simple random sampling allows the population to be chosen to have equal probability. All students were identified and then each student was assigned a number. The specimens were then collected using the lottery process.

The randomly-selected sample produces, according to Creswell (2009), study results that can be generalized within margins of error and statistically calculated via the equation to broader populations. Random sample selecting and assigning a subject also involves the elimination of systematic distortions and minimizing the effects of foreign variables. However, chemistry teachers have been purposely chosen for the study.

3.7 Research Instruments

According to Meere (2006) the most commonly used instruments for data collections among social scientists are questionnaires, interview schedules and observations. The main data collection instruments were questionnaires and observation schedule.

3.7.1 Student Questionnaire

A questionnaire refers to a collection of items that are normally responded in writing by a respondent (Kothari, 2008). For the secondary school students, standardized questionnaires are administered. The Form Three Students in Nandi North Sub-County high schools received a total of 303 questionnaires. The

questionnaire was divided into three chapters, and the first covered the student demographic definition.

Section two had questions related to attitude of girls towards learning of Chemistry, while section three had information on effects of teacher interaction styles on secondary school students' achievement in Chemistry and section four dealt with the extent of influence of availability of teaching/learning materials on secondary school students' achievement in Chemistry. The items in the questionnaire were on a five-point Likert scale where the items were rated as; 1=Strongly Disagree (SD); 2=Disagree (D); 3=Undecided (UD); 4=Agree (A); and 5=Strongly Agree (SA). The questionnaire is indicated as Appendix ii.

3.7.2 Interview Schedule

The interview schedule has been semi structured and questions relating to the research objectives have been developed. The schedule for interviews (Annex iii) was given to chemistry teachers in the sampled schools. A discussion with a specific purpose is a kind of interview. Schedules of interviews provided quality data. Qualitative information is collected' most frequently' by researchers through interviews and surveys.

Interviews, however, are more effective in obtaining narration data compared to questionnaires that allow researchers to explore more deeply the opinions of people (Kvale and Brinkmann, 2009). In a similar vein, Cohen & al (2007) add that interviews are "a valuable way to explore meaning building and negotiation in a natural environment." Moreover, an interview is valued not only for the purpose of producing a complete snapshot, analyzing words and providing detailed reports on

the informants, but also because interviewees are able to speak their thoughts and feelings in their own voices (Berg, 2007).

3.7.3 Classroom Observation Schedule (COS)

This involves utilizing an observation schedule to record what is observed during data collection, (Annum, 2016). First the behaviours must be defined and then a detailed list of behaviours developed. During data collection, each item was checked off as it occurred. The type of interaction styles used by teachers during the chemistry lessons was observed (COS) was used in order to determine the interaction styles commonly used by the teachers and how effective they are in the teaching and learning of chemistry. The observation schedule is indicated as Appendix IV.

3.8 Validity and Reliability of the Research Instruments

This section presents the validity and reliability of the research instruments used in the study.

3.8.1 Validity

According to Kothari (2008) validity is the correctness, significance of inferences and the correctness of the results of the study are the basis. The quality and the accuracy of research instruments in this analysis were looked after by the experts. Feedback from scholars were used before the real data collection process was initiated to improve the research tools. On the one hand, content validity is a non-statistical validity type, which requires a comprehensive analysis of the test contents to determine whether the contents cover a representative sample of behavioral domains to be identified (Anastasi & Urbina, 1997).

In addition, content validity evidence involves the degree to which the content of the test matches a content domain which is linked with the construct of the instruments. A test is said to have content validity built into it when there is careful selection of which items to be included. Items are carefully selected so that they comply with the test specifications which are drawn up through a methodical examination of subject area.

The reliability of an instrument's content can be improved by using a panel of scholars to analyze the test parameters and pick objects. The experts would analyze the items and report on if the items include a representative sample of the area of behavior. The questionnaires were used by supervisors and a panel of qualified researchers from the University of Eldoret, School of Education to examine these instruments and check the validity of the instruments used in the analysis. In the final revisions to instrument, the experts ' suggestions are integrated to boost its reliability.

3.8.2 Reliability of the Research Instruments

The degree to which a testing instrument generates consistent results or data following repeated tests is reliability (Mugenda and Mugenda, 2003). A pilot study was carried out at three high schools in Nandi Central Sub-County with almost the same characteristics as Nandi North Sub-County to assess the quality of the questionnaire items. Piloting is important to determine the quality of the instrument's content and to develop problems, formats and measurements.

Validity of content is a non-statistical type of validity involving the systematic examination of the test content in order to determine if it covers a representative

sample of the component field to be measured. Contained proofs of validity include the extent to which the content of the experiment fits a built-in content environment. A check with careful selection has the validity of the material.

The questionnaire was given to pupils from the schools chosen in the sub-county and subsequently to test the accuracy of instruments with a Cronbach Alpha coefficient. A correlation coefficient equal to or greater than 0.70 was deemed appropriate to allow the analysis to be carried out in compliance with Creswell's recommendation (2009). In this sample, 0.79 in the interview questionnaire and 0.71 in the interview scheme were obtained and therefore considered reliable and used for gathering research information.

3.9 Data Collection Procedure

Before embarking on data collection, research permit was obtained from National Commission of Science, Technology and innovations (NACOSTI) and Sub-County Education office, Nandi North Sub-County. Upon granting permission, each secondary school sampled in the sub-County was visited for purposes of familiarization and in an effort to obtain permission from the school administration for the expected date of collection of data within their schools.

Once the research was permitted to be completed, all participants received questionnaires. The response to every questionnaire item after which all questionnaires were collected for data analysis immediately was given to the respondents. A 30-minute interview schedule was administered to the chemistry

teachers. Further, Form three Chemistry lessons in the selected schools were observed using the classroom observation schedule.

3.10 Data Analysis

For this analysis, data collected are analyzed in concise and inferential statistics. The questionnaire included four-point scale questions which were graded in the following ways: Strongly Disagree (SD)= 1. Disagree(D)=. 2. The data were analyzed with frequency numbers and percentages. Prior to reporting in stories and quotations, the quality data from the interviews and observations were classified and arranged in terms of the research objectives.

3.11 Ethical Considerations

Ethics are the norms of conduct according to Luey (2005), which differentiate between actions acceptable and unacceptable. During academic research, writing and publication processes, a variety of ethical problems can arise. Plagiarism, manufacturing or falsifying data, conflicts of interest, privacy, care and authorship problems of human and animal subjects. The respondents were ensured that the information they gave was confidential and had to sign an informed consent before they took part. The final report or any other correspondence drafted during the study did not contain any information disclosing the identity of any person, unless prior written consent had been given to their inclusion in this document.

Honesty has also been found. There were honest reports of data, outcomes, methods and procedures. The details have not been fabricated, falsified or misrepresented. Similarly, the highest priority of consideration was objectivity. In data analysis, data interpretation and other research aspects, where objectivity and fairness were

also needed, was avoided. Promises were kept and agreements were acted with sincerity, consistency of thought and action were stored for. A lot of care was observed in carrying out research.

3.12 Chapter Summary

This chapter explains the field of study, the nature and methodology of the research, the sample study, the test instrument on sampling methods, study validity and reliability, data collection, analyzes and adherent ethical considerations. The next chapter analyzes information collected by questionnaire, interview, and classroom observations, both in terms of quantitative and qualitative information.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND DISCUSSIONS OF THE FINDINGS

4.1 Introduction

This chapter presents results of the analyzed data on factors contributing to poor performance in chemistry by girls in Nandi North Sub-County, Kenya. The chapter is sub-divided into five sub-headings with section one covering the demographic information of the participants involved in the study, section two covers the attitude of girls towards learning of Chemistry.

Section three dealt on effects of teacher interaction styles on secondary school students' achievement in Chemistry and section four covered the extent of influence of availability of teaching and learning materials on secondary school students' achievement in Chemistry while the last section covered the perception of teachers towards teaching of Chemistry in secondary schools. The chapter opens with the return rate of the questionnaires used in the study followed by the demographic information of the respondents.

4.2 Questionnaire Return Rate

A total of 286 out of 303students fully filled and returned the research questionnaires. In addition, 9 out of 13 teachers were interviewed in the sub-county while 9 classroom observations were made. The rate of return for data analysis questionnaires used was 94.4%, whereas for 69.2%, the interview rate was considered sufficient to provide appropriate and reliable information on the factors contributing to poor chemistry quality among girls in Nandi North.

The outcome of certain questionnaires given to students, but not filled out, and returned, was a rate of 94.4% in this report. Potential bias could be caused by low reactions (Brick & Williams, 2013) and thus high reactivity in the information collected was associated with a high level of data reliability in the current study. Further Pike, (2007) noted that survey investigators have for a long time presumed that the best method to obtain impartial estimations is to attain a high response proportion. However, most researchers have begun to query the extensively-held supposition that low response levels may give biased outcomes (Groves, 2006; Peytchev, 2013; Massey & Tourangeau, 2013).

4.3 Demographic Information of the Respondents

According to Wise *et al*., (2012), when designing a survey, the research needs to assess who to survey and how to breakdown overall survey response data into meaningful groups of respondents. Both assessments are based on demographic considerations. In this study, the demographic information that was sought from the respondents was gender and school type.

4.3.1 Gender of the Respondents

Students were asked to designate their gender in the research questionnaire that was provided. The outcomes of the analyzed information are shown in Figure 4.1.

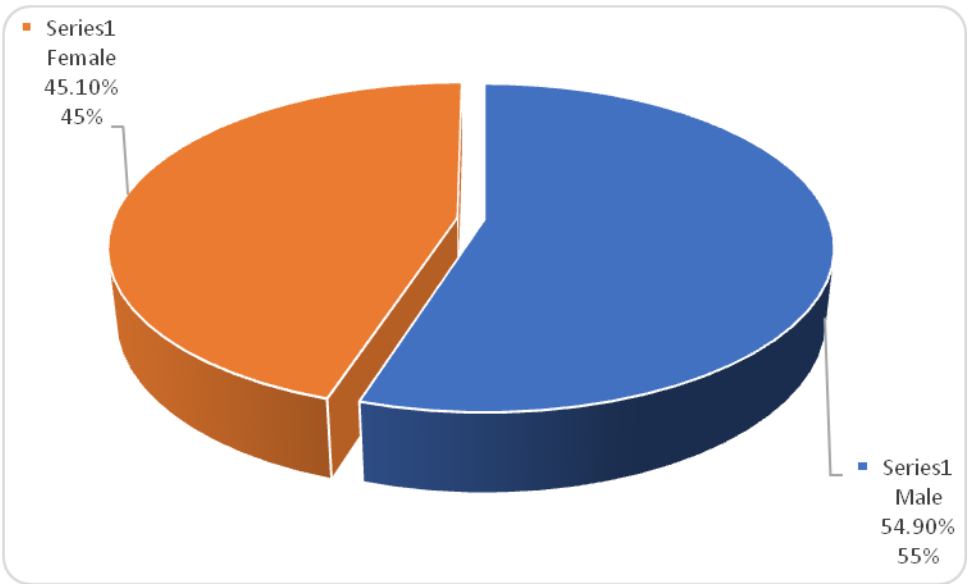

Figure 4.1: Gender of Respondents

Figure 4.1 shows that 54.90% (157) respondents were male while 45.10%(129) respondents were female. From the responses, it emerged that majority (54.90%) of the respondents were male as compared to their female counterparts implying that majority of the students in the study area are male. According to Okwo and Otunba (2007) gender influences achievement and boys are deemed to perform better than girls in sciences.

4.3.2 School Type

Secondary school students who took part in the study were requested to indicate the type of school where they were enrolled in. The type of schools sought were categorised as either girls only, boys only or mixed schools. Student responses were tabulated and the results are presented in Figure 4.2.

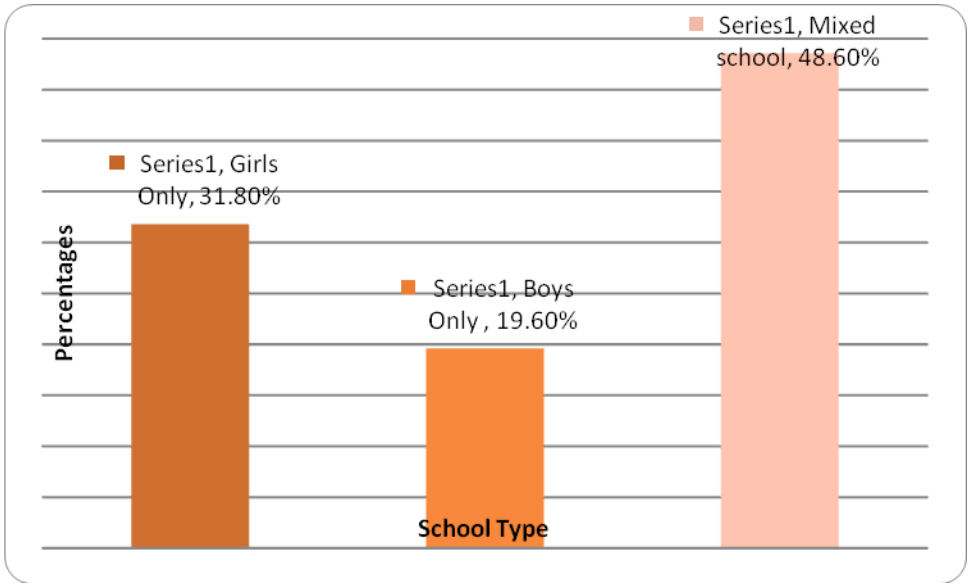

Figure 4.2: Respondents' School Type

Figure 4.2 shows that 48.60%(139)students were enrolled in mixed secondary schools and 31.8%(91) students were enrolled in girl schools while 19.60%(56) students were enrolled in boy schools. From the responses, it emerged that most (48.60%) of the students who participated in this study were from mixed secondary schools. This implies that there are more mixed secondary schools in Nandi North sub-county as compared to pure girls' or boys' schools.

4.4 Attitude towards Learning of Chemistry

The first objective of the research was to explore girls ' approach to chemical education. To do this, students were asked to assess their agreement on the attitude to chemistry learning by using a three-point Likert-scale questionnaire. They answered and reported the results in Table 4.1.

Table 4.1: Effect of Attitude towards Students' Learning of Chemistry

Statement	Gender	Disagree		Undecided		Agree	
		Freq	%	Freq	%	Freq	%
Confidence in Chemistry							
I am sure that I can learn chemistry.	Male	28	17.9	22	14.0	107	68.1
	Female	74	57.4	19	14.7	36	27.9
I am sure of myself when I do chemistry.	Male	28	17.8	8	5.1	121	77.1
	Female	98	76.0	11	8.5	20	15.5
I think I can handle more difficult chemistry questions.	Male	40	25.5	9	5.7	108	68.8
	Female	63	48.8	25	19.4	41	31.8
Perception towards chemistry Teachers							
My teachers have been interested in my progress in chemistry.	Male	29	18.5	10	6.4	118	75.2
	Female	19	14.7	2	1.6	108	83.7
My teachers have encouraged me to study more chemistry.	Male	29	18.5	37	23.6	91	58.0
	Female	26	20.2	3	2.3	100	77.5
I would talk to my chemistry teacher about a career that uses chemistry.	Male	40	25.5	6	3.8	111	70.7
	Female	26	20.2	15	11.6	88	68.2
Usefulness of Chemistry							
Knowing chemistry will help me earn a living.	Male	42	26.8	33	21.0	82	52.2
	Female	79	61.2	19	14.7	31	24.0
I will need chemistry for my future work.	Male	52	33.1	5	3.2	100	63.7
	Female	74	57.4	2	1.6	53	41.1
Chemistry is a worthwhile necessary subject	Male	25	15.9	12	7.6	120	76.4
	Female	78	60.5	4	3.1	47	36.4

Table 4.1 shows that 107(68.1%) male students and 36(27.9%) female students agreed with the statement that they were sure they can learn chemistry, 28(17.9%)

male and 74(57.4%) female students disagreed with the statement and 22(14.0%) male and 19(14.7%) female students were undecided on the statement. The study findings showed that majority (68.1%) of male students believed that they were sure of learning chemistry while majority (57.4%) of the female students were not sure of learning chemistry. This shows that male students were more confident of learning chemistry as compared to female students. The findings therefore point out that poor confidence among girls in learning chemistry contributes to their poor performance in the subject. This agrees with the findings of Ssempala (2005) who noted in that girls had poor self confidence in their ability to learn chemistry as most of them believed that boys were better in sciences.

In addition, 121(77.1%) male and 20(15.5%) female students agreed with the statement that they were sure of themselves when doing chemistry, 28(17.8%) male and 98(76.0%) female students disagreed with the statement while 8(5.1%) male and 11(8.5%) female students were undecided on the statement. From the responses, it emerged that majority (77.1%) male students believed that they were sure of themselves when doing chemistry as compared to majority (76.0%) of the females who believed that they were not sure of themselves when doing chemistry. This implies that girls lack self-confidence while undertaking chemistry problems. Studies have suggested that even many high-achieving girls have low levels of confidence in their ability to solve science and mathematics problems and express high levels of anxiety towards these subjects (Akporehwe & Onwioduokit, 2010).

On the statement that "I think I can handle more difficult chemistry questions", 108(68.8%) male and 41(31.8%) female students agreed with the statement, 40(25.5%) male and 63(48.8%) female students disagreed with the statement and 9(5.7%) male and 25(19.4%) female students were neutral on the statement. From the responses, it emerged that majority of the male students (68.8%) believed that they could handle more difficult chemistry operations while most (48.8%) of the female students believed that they were not able to handle more difficult questions. This therefore shows that male students had more confidence in handling difficult chemistry questions in comparison to their female counterparts. Thus, for this case it seems that female students have high anxiety when it comes to handling of chemistry questions in comparison to male students. This concur with the findings of Hyde *et al.*(1990)who found out that women reported greater levels of anxiety about mathematics than men.

In addition, 118(75.2%) male and 108(83.7%) female students agreed with the statement that their teachers were interested in their progress in chemistry, 29(18.5%) male and 19(14.7%) female students disagreed with the statement while 10(6.4%) male and 2(1.6%) female students were undecided on the statement. The responses showed that majority of both male (75.2%) and female students (83.7%) believed that their teachers were interested in their progress thus showing a positive attitude towards their teachers. This points out that a positive attitude by both male and female students towards teachers will in turn lead to a better achievement in chemistry. This is consistent with the works of Sofiani *et al.*, (2017) who noted that students' attitude towards science varies among the students, depends on

factors that are associated with the teacher, such as teaching methods, classroom management, and teachers' knowledge of content and personality.

Similarly, 91(58.0%) male and 100(77.5%) female students agreed with the statement that their teachers encouraged them to study more chemistry, 29(18.5%) male and 26(20.2%) female students disagreed with the statement while 37(23.6%) male and 3(2.3%) female students were undecided on the statement. From the responses, it emerged that majority of both male (58.0%) and female (77.5%) students believed that they were encouraged by their teachers to study more chemistry. This implies that female students had a more positive attitude towards the encouragement that was provided by their teachers.

In addition, 111(70.7%) male and 88(68.2%) female students agreed with the statement that they talked to their chemistry teachers concerning careers that apply chemistry, 40(25.5%) male and 26(20.2%) female students disagreed with the statement and 6(3.8%) male and 15(11.6%) female students were undecided on the statement. From the responses, it emerged that majority of both male111(70.7%) and female 88(68.2%) believed that they communicated with their teachers concerning careers that needed chemistry. This shows that male and female students had a positive attitude towards careers that had chemistry even though male students had a more positive attitude than the female students. One of the key factors in learning science is students' attitudes and the development of positive attitudes toward science can motivate student interest in science education and science-related careers (George, 2006).

Further, 82(52.2%) male and 31(24.0%) female students agreed with the statement that knowing chemistry will help them earn a living, 42(26.8%) male and 79(61.2%) female students disagreed with the statement and 33(21.0%) male and 19(14.7%) female students were undecided on the statement. From the responses, it emerged that majority 82(52.2%) of male students believed that knowing chemistry would help them earn a living while majority79(61.2%) female students believed otherwise showing that female students had a negative attitude towards the usefulness of chemistry. This concurs with a study by Majere, Role, & Makewa (2016) on self-concept, attitude and perception of usefulness of physics and chemistry according to type and location of schools which found out that difference in perception of the usefulness of Chemistry was statistically significant between students in urban schools.

Further, 100(63.7%) male and 53(41.1%) female students agreed with the statement that they needed chemistry for their future work, 52(33.1%) male and 74(57.4%) female students disagreed with the statement and 5(3.2%) male and 2(1.6%) female students were neutral on the statement. As shown by the responses, it emerged that majority (63.7%) of the male students believed that they needed chemistry for their future work while majority (57.4%) of the female students believed otherwise. This implies that female students had a more negative attitude towards importance of chemistry in their future work. This therefore shows that they tend not to make an effort to learn and understand the meaning of chemistry concepts that are being taught to them. It was shown that the most effective factor contributing to students' decisions to study science is their interest in the subject (Lindahl, 2003).

Therefore, in this study female students showed negative attitude towards importance of chemistry thus affecting their performance.

Similarly, 120(76.4%) male and 47(36.4%) female students agreed with the statement that chemistry is a worthwhile and necessary subject, 25(15.9%) male and 78(60.5%) female students disagreed with the statement and 12(7.6%) male and 4(3.1%) female students were undecided on the statement. The study findings showed that majority (76.4%) of the male students believed that chemistry is a worthwhile and necessary subject while on the contrary, majority (60.5%) of the female students in the study area believed otherwise. The study shows that male students are more positive on the importance of chemistry but the female students attach no significance to chemistry. This was found to concur with the findings of Barnes *et al*. (2005) in Australia which revealed that the attitudes of boys towards chemistry was more positive than were those of girls. This therefore shows that the negative attitude of girls towards the usefulness of chemistry plays a significant role in their performance.

In this study, independent sample t-test was performed to determine whether there was a significant difference between the means of male and female students on their attitude towards learning of chemistry. The results are presented in Table 4.2.

Table 4.2: Difference in the means of male and female students on their attitude towards learning of chemistry

		Levene's Test for Equality of Variances		*t-test for Equality of Means*						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Confidence in Chemistry	Equal variances assumed	28.595	.000	2.479	284	.014	.25922	.10457	.05338	.46506
	Equal variances not assumed			2.582	269.383	.010	.25922	.10040	.06156	.45688
Perception towards chemistry teachers.	Equal variances assumed	12.667	.000	.293	284	.769	.03287	.11201	-.18761	.25335
	Equal variances not assumed			.286	235.497	.775	.03287	.11496	-.19361	.25935
Usefulness of Chemistry	Equal variances assumed	7.172	.008	-5.633	284	.000	-.39887	.07081	-.53825	-.25949
	Equal variances not assumed			-5.550	253.723	.000	-.39887	.07187	-.54041	-.25734

Table 4.2 points out that all the three variables under attitude on this study (Confidence in Chemistry, Perception towards chemistry teachers and Usefulness of Chemistry) were all significant ($p \leq .05$). In this study, students' Confidence in Chemistry had a p-value of .000 and students' Perception towards chemistry teachers had a p-value of .000 while students' perception towards usefulness of Chemistry had a p-value of Usefulness of Chemistry which indicates that the variances (for boys and girls) are significantly different. This shows that there was a significant difference between boys and girls in terms of attitude towards chemistry (Confidence in Chemistry, Perception towards chemistry teachers and Usefulness of Chemistry).

On interviewing teachers of chemistry, it emerged that in comparison to girls, there were more boys who enjoyed learning chemistry particularly in mixed secondary schools. However, in girl schools, there were girls who were very good in Chemistry and categorically wanted to further their careers in chemistry. In one of the girl schools, the chemistry teacher had this to say:

> **Teacher 5:** In my class I have over ten girls who usually score A in chemistry and are determined to do courses related to chemistry in the university.

The sentiments show that despite majority of the girls having a negative attitude in chemistry as a subject, there are some bright girls who would want to take chemistry as a subject and are performing better than most boys in chemistry. This

therefore shows that the negative attitude that is displayed by most girls towards chemistry is not a pointer that they cannot outperform their male counterparts.

Observation that was conducted pointed out that most of the girls were taking chemistry as a subject in comparison to other science subjects like physics. This was particularly noted in those schools where chemistry was an optional subject. However, in some schools, chemistry was considered to be an important subject therefore was made to be compulsory to be undertaken by all students.

4.5 Effect of Teacher Interaction Styles on Secondary School Students' Achievement in Chemistry

The second objective of this study was to establish the effects of teacher interaction styles on secondary school students' achievement in Chemistry in Nandi North Sub-County. To achieve this objective, the respondents were requested to rate their level of agreement in a five-point Likert scale items on effect of teacher interaction styles on secondary school students' achievement in chemistry. Their responses were tabulated and the results of the analysed information are presented in Table 4.3.

Table 4.3: Responses on Effect of Teacher Interaction Styles on Secondary School Students' Achievement in Chemistry

Statement	SD		D		UD		A		SA	
	freq	%	freq	%	freq	%	freq	%	Freq	%
Female students who are taught by teachers who rely on lectures perform better in chemistry.	51	17.8	120	42.0	11	3.8	76	26.6	28	9.8
Use of discussion groups enables girls to perform well in chemistry.	37	12.9	50	17.5	18	6.3	116	40.6	65	22.7
Girls are who guided by teachers both in practical and theoretical chemistry perform better in the subject.	22	7.7	35	12.2	18	6.3	117	40.9	94	32.9
Girls exposed to chemistry practical work perform better than those who have not been exposed to practical work.	48	16.8	18	6.3	21	7.3	101	35.3	98	34.3
Teachers who usually give feedback to students' responses enables girls to perform better in chemistry.	28	9.8	40	14.0	40	14.0	136	47.6	42	14.7

Table 4.3 shows that 120(42.0%) respondents disagreed with the statement that female students who are taught by teachers who rely on lectures perform better in

chemistry, 76(26.6%) respondents agreed with the statement, 51(17.8%) respondents strongly disagreed with the statement and 28(9.8%) students strongly agreed with the statement while 11(3.8%) students were undecided on the statement. From the study it means therefore that majority (59.8%) of the students in secondary schools in Nandi North sub-county believed that female students taught through lecture method performed poorly in chemistry. This implies that the use of lecture method is not advisable for teaching chemistry and therefore other methods of teaching chemistry need to be devised and lecture method reduced or done away with during chemistry instruction. This agrees with the findings of Colleen (2014) who found out that guided-inquiry and partial guided-inquiry students had a statistically significant improvement in these grades over students taught by lecture only. This therefore points out that lecture method is not a desired chemistry instruction mode.

Further, 116(40.6%) respondents agreed with the statement that use of discussion groups enables girls to perform well in chemistry, 65(22.7%) students strongly agreed with the statement, 50(17.5%) students disagreed with the statement and 37(12.9%) students strongly disagreed with the statement while 18(6.3%) students were neutral on the statement. From the responses, it emerged that majority (63.3%) of the respondents noted that use of discussion groups enabled girls to improve on their performance in chemistry. This therefore shows that teachers need to use discussion groups as a way of instruction for girls as this is associated with improved academic performance. According to Robyn and Adrian (2003), one practice that has received widespread coverage over the past decades is cooperative

or small-group learning which according to Gillies and Boyle (2010) is a pedagogical practice that helps students to gain and create both academic and social relationships as well as to accomplish shared objectives.

In addition, 117(40.9%) students agreed with the statement that girls who guided by teachers both in practical and theoretical chemistry perform better in the subject, 94(32.9%) students strongly agreed with the statement, 22(7.7%) students strongly disagreed with the statement and 35(12.2%) students disagreed with the statement while 18(6.3%) students were undecided on the statement. From the responses, it emerged that majority (73.8%) of the secondary school students in Nandi North Sub-County agreed that girls who guided by teachers both in practical and theoretical chemistry perform better in the subject. This implies that girls will only perform well in chemistry when they are well guided by their teachers. Practical work is thought to provide learners with evidence to support their understanding and to concretise scientific principles (Jormanainen, 2006). Thus, learners are exposed to basic processes of science through practical work.

Similarly, 101(35.3%) students agreed with the statement that girls exposed to chemistry practical work performance better than those who have not been exposed to practical work, 98(34.3%) students strongly agreed with the statement, 48(16.8%) students strongly disagreed with the statement and 21(7.3%) students were undecided on the statement while 18(6.3%) students disagreed with the statement. As shown by the responses, it can be argued that majority (69.6%) of the secondary school students in the study area were of the view that girls exposed to regular chemistry practical work performed better than those who have not been

exposed to practical work. This therefore shows that students need to be exposed to practical work on regular basis so as to improve on their academic performance. This is consistent with other researchers including Orora, *et al.*, (2014) and Otuka, & Uzoechi (2009) who noted in their studies that the poor performance and laboratory proficiency in biology are influenced by not having expository approaches that stand up to challenge the objectives of biology education. Thus, schools should be encouraged to adopt pedagogical practices that promote the active involvement of students' learning (Glomo-Narzoles, 2015).

In addition, 136(47.6%) students agreed with the statement that teachers who usually give feedback to students' responses enable girls to perform better in chemistry, 42(14.7%) students strongly agreed with the statement, 40(14.0%) students disagreed with the statement and another 40 (14.0%) students were undecided on the statement while 28(9.8%) students strongly disagreed with the statement. The study findings showed that majority (62.3%) of the students in secondary schools in Nandi North Sub-County believed that teachers who usually give feedback to students' responses enable girls to perform better in chemistry. This shows that timely feedback for students' work enables them to gauge their understanding of the subject and therefore improve on specific areas leading to overall performance in the subject. Kelly & Antonio, (2016) argued that teachers provide students input is one of the most influential measures of educational support. Essentially feedback informs students of their success or comprehension on a specific subject (Andersson & Palm, 2017; Gielen, Peeters, Dochy, Onghena & Struyven, 2010). The aim is to enable students to self-regulate learning by, for

instance, interpreting external input from teachers and providing internal feedback (Nicol & Macfarlane-Dick, 2006). This is the intention of students to monitor and control their learning activities in accordance with their learning objectives.

In addition, t-test was used to test determine whether there was a significant difference between the means of male and female students on effect of teacher interaction styles on secondary school students' achievement in Chemistry. The results of the analyzed information are presented in Table 4.4.

Table 4.4: Means of Male and Female Students on Effect of Teacher Interaction Styles on Secondary School Students' Achievement in Chemistry

		Levene's Test for Equality of Variances		*t-test for Equality of Means*						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Interaction style	Equal variances assumed	5.303	.022	-1.633	284	.103	-.16238	.099	-.358	.0333
	Equal variances not assumed			-1.601	245.81	.111	-.16238	.1014	-.3621	.03734

Table 4.4 shows that when equal variance was assumed, there was a significant difference between male and female students ($p \leq .05$) on effect of teacher interaction styles used in chemistry on secondary school students' achievement in the subject. This shows that various interaction styles favour girls than boys and vice versa therefore teachers of chemistry need to be aware on the best interaction

style to use. This finding supports the work of Akpokorie (2000) and Omajuwa (2011) whose study showed that students find most process skills difficult. According to earlier work of Ajaja (2010), the reason why students may find all process skills difficult could be due to the persistent use of lecture methods for teaching Chemistry as against the recommended use of laboratory and discovery/inquiry approaches which are student-activity centered.

4.6 Influence of Availability of Teaching and Learning Materials on Secondary School Students' Achievement in Chemistry

The third objective of this study was to determine the extent of influence of availability of teaching/learning materials on secondary school students' achievement in Chemistry. To achieve this objective, the study participants were requested to rate their level of agreement on a five point Likert scale items in the questionnaire on extent of influence of availability of teaching and learning materials on secondary school students' achievement in Chemistry. The results of the analyzed information are presented in Table 4.5.

Table 4.5: Responses on influence of availability of Teaching and Learning Materials on Secondary School Students' Achievement in Chemistry

Statement	SD		D		UD		A		SA	
	freq	%	freq	%	Freq	%	freq	%	Freq	%
Our school has well equipped chemistry Laboratories making students to be acquainted to laboratory techniques.	104	36.4	87	30.4	15	5.2	47	16.4	33	11.5
There are adequate number of chemistry teachers in our school.	168	58.7	34	11.9	0	0.0	58	20.3	26	9.1
There are sufficient chemistry course books in our school.	125	43.7	61	21.3	20	7.0	58	20.3	22	7.7
The school has adequate laboratory manuals and charts for students.	100	35.0	108	37.8	16	5.6	52	18.2	10	3.5
There are adequate and spacious classrooms in our school.	101	35.3	101	35.3	8	2.8	39	13.6	37	12.9

Table 3.5 reveals that 104(36.4%) respondents are strongly against a statement saying their schools have highly qualified chemical laboratories making students familiar with lab techniques, 87(30.4%), 47(16.4%), 47(11.5%) respondents agree, 33(11.5%) respondents agree strongly with that argument. Studies show that most (66.8 percent) of high school pupils thought that their school lacks well-equipped chemical laboratories that render them unaware of lab techniques. This shows that

secondary schools need to equip their laboratories in order to allow students to be acquitted with laboratory techniques thus improving on their performance in chemistry.

This study findings are similar to those of other researchers including Adeyemi, (2008) and Arokoyu & Ugonwa, (2012) amongst others who have reported that inadequate laboratory facilities were responsible for poor performance in the subject. The lab is a key tool for teaching and learning in chemistry. The Chemical laboratory, which plays such an important role, offers a large amount of special equipment for the students. Nevertheless, the students need a high standard of training to use the equipment.

However, 168 (58.7%) students strongly did not agree with the statement that there was a sufficient number at their schools of chemical teachers, 58 (20.3%) respondents agreed and 34 (11.9%) disagreed, while 26(9.1%) respondents agreed strongly with the statement. From the responses, it emerged that majority (70.6%) of the students in secondary schools in Nandi North Sub-County reported that there were inadequate chemistry teachers in their schools.

This is a pointer that secondary school students in the region lacked adequate instruction in chemistry thus hindering the performance in the subject. This therefore points out that there is need for the government to recruit more chemistry teachers in the study area so as to enhance learners' academic performance in chemistry. This study finding is in congruence with those of Boyd & Barbarin,

(2008) who noted in their study that teacher adequacy can compromise the quality of education.

Similarly, 125(43.7%) teachers strongly disagreed with the statement that there are sufficient chemistry course books in their schools, 61(21.3%) students disagreed with the statement, 58(20.3%) students agreed with the statement and 22(7.7%) students strongly agreed with the statement while 20(7.0%) students were undecided on the statement. The responses suggested that majority (65.0%) of the Form three learners in Nandi North Sub-County reported that they lacked adequate chemistry books in their schools thus affecting negatively their chemistry studies. This is in line with UNESCO report (2005) which pointed out that the large increase in the number of students without the addition of resources in the schools affected the quality of education.

Further, 108(37.8%) students disagreed with the statement that their schools had adequate laboratory manuals and charts for students, 100(35.0%) students strongly disagreed with the statement, 52(18.2%) students agreed with the statement and 16(5.6%) students were undecided on the statement while 10(3.5%) students strongly disagreed with the statement. The study therefore showed that majority (72.8%) of the students believed that there were inadequate laboratory manuals and charts hindering proper utilization of laboratory equipment. This shows that students lacked laboratory concepts due to inadequacies in laboratory manuals and charts. The maps, posters and sketches clearly communicate information and ideas in

combination of diagrams, words and pictures, according to Soetan et al. (2010). The use of maps in teaching provides the materials being analyzed unequivocally.

In addition, 101(35%) of students strongly disagreed that the schools have sufficient and spacious classrooms, 101(35%) of them disagreed, and 39(13%) students agreed and 37(12.9%) strongly agreed with the claim, while 8(2.8%) students disagreed with the argument. From the responses, it emerged that majority (70.6%) of the students believed that classrooms in their schools were not adequate and spacious. This implies that public secondary schools in the study area were congested thus making the teaching and learning process to be difficult. This therefore shows that there is need for construction of more classrooms in the study area to ease congestion during the learning process. The increased enrolment in secondary schools due to Free Day secondary Education (FDSE) has led to increased number of students in a classroom. According to Yusuf (2015), classrooms are used as appropriate places for seeking and acquiring education usually from a teacher to the learners.

Further, independent sample t-test was performed to determine whether there was a significant difference between the means of male and female students on influence of availability of teaching and learning materials on secondary school students' achievement in chemistry. The results are presented in Table 4.6.

Table 4.6: Independent sample t-test on influence of availability of teaching and learning materials on secondary school students' achievement in chemistry

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower Upper
Instructional Style	Equal variances assumed	.494	.483	-3.223	284	.001	-.20778	.06446	-.3347 -.0809
	Equal variances not assumed			-3.247	279.844	.001	-.20778	.06399	-.3337 -.0818

Table 4.6 shows that there was no significant difference on the mean of boys and girls on influence of availability of teaching and learning materials on secondary school students' achievement in chemistry ($p \geq .05$). This shows that the adequacy and availability of teaching and learning materials affect both boys and girls equally in their performance in chemistry subject.

Interviews conducted pointed out that there were inadequate laboratories almost in all the schools in the study area. In addition, most schools lacked adequate chemistry textbooks, laboratory manuals and charts. This affected the performance of students in Chemistry.

4.7 Perception of Teachers towards Teaching of Chemistry

The fourth objective of this study was to investigate the perception of teachers towards teaching of Chemistry in secondary schools. To achieve this objective, teachers were interviewed with an aim of understanding their attitude towards chemistry. A total of 9 teachers were interviewed in this study and their responses were analysed qualitatively and presented.

From the interviews conducted with teachers, it emerged that most of the teachers particularly those in less developed schools with poor infrastructure had a negative attitude towards teaching of chemistry. This is attributed to the fact that most of these school's lack laboratories thus teaching chemistry theoretically. Most of the students in these schools lack the practical part of chemistry and yet chemistry is a practical oriented subject. Teachers had these to say:

> **Teacher 4:** I have been teaching chemistry for the last ten years yet there is no student who has attained a grade B and above in my subject. I attribute this to lack of a good well stocked laboratory in my school. My students never attend practical part of chemistry and are expected to sit for the same examinations as those schools with well-established laboratories.

However, it also emerged that teachers in "big schools" or well established schools had a positive attitude towards teaching chemistry. This is owed to the fact that they have adequate teaching resources, well equipped chemistry laboratories and are advantageous position of having a low student teacher ratio. A teacher interviewed from one of the well-established schools, had this to say:

Teacher 6: I enjoy teaching chemistry in this school since my students grasp chemistry concepts easily. Every week our students have to undertake at least one chemistry practical thus exposing them to the concepts of real chemistry.

The above sentiments point out that teachers' attitude towards teaching of chemistry is dependent particularly on teaching and learning resources which are available in their schools.

Inability to carry out realistic inquiries leads to students ' inductive processes of analyzing the world and drawing conclusions without being able to attain their objective of teaching students critical thinking skills (CAPS 2011). The Chemical Curriculum of the secondary school, however, offers many examples of work that can be carried out with each subject, but teachers do not eventually carry out the necessary practices, because they weight less when it comes to assessments and have no laboratories that carry out this practical part at the same time (Moodley, 2013).

4.8 Chapter Summary

This chapter outlined the views of Chemistry students, Chemistry teachers of Nandi North Sub-County with regard to issues responsible for the persistent poor performance of girls in Chemistry within the Sub-County. The analysis showed that background characteristics, teachers' negative attitude towards learners' ability in Chemistry and inappropriate learning environments were the main causes of persistent poor performance of Nandi County Chemistry students.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This section gives the summary, conclusion and recommendations of the findings on factors contributing to poor performance in chemistry among girls in secondary school in Nandi North Sub-County, Kenya. These are based on the four objectives of the study.

5.2 Summary of the Findings

The purpose of this study was to determine the factors influencing the performance of girls in chemistry subject in secondary schools in Nandi North Sub-County, Nandi County, Kenya. Specifically, the study addressed the attitude of girls towards learning of Chemistry, effects of teacher interaction styles on secondary school students' achievement in Chemistry, the extent of influence of availability of teaching and learning materials on secondary school students' achievement in Chemistry and the perception of teachers towards teaching of Chemistry in secondary schools. Data was collected from students and teachers of chemistry through the use of questionnaires, interviews and observation schedule. The collected data was analyzed through quantitative and qualitative approaches. The analyzed information revealed the following;

5.2.1 Demographic Information of the Respondents

In this study majority (54.9%) of the students were male as compared to their female counterparts while most (48.6%) of the students who participated in this study were from mixed secondary schools. This implies that there are more mixed

secondary schools in Nandi North sub-county as compared to girls' or boys' schools.

5.2.2 Attitude of Girls towards Learning of Chemistry

The first objective of this study was to investigate the attitude of girls towards learning of chemistry. The study findings showed that (68.1%) of male students believed that they were sure of learning chemistry while majority of the female students (57.4%) were not sure of learning chemistry. This shows that male students were more confident of learning chemistry as compared to female students. The findings therefore point out that poor confidence among girls in learning chemistry might contribute to their poor performance in the subject. This agrees with the findings of Ssempala (2005) who noted that girls had poor self confidence in their ability to learn chemistry as most of them believed that boys were better than them in sciences.

In addition, it emerged that majority (77.1%) male students believed that they were sure of themselves when doing chemistry as compared to majority (76.0%) of the females who believed that they were not sure of themselves when doing chemistry. This implies that girls lack self-confidence while undertaking chemistry problems. Studies have suggested that even many high-achieving girls have low levels of confidence in their ability to solve science and mathematics problems and express high levels of anxiety towards these subjects (Akporehwe & Onwioduokit, 2010

Similarly, majority of the male students (68.8%) believed that they could handle more difficult chemistry operations while most (48.8%) of the female students

believed that they were not able to handle more difficult questions. This therefore shows that male students had more confidence in handling difficult chemistry questions in comparison to their female counterparts. Thus, for this case it seems that female students have high anxiety levels when it comes to handling of chemistry questions in comparison to male students. This concurs with the findings of Hyde *et al.* (1990) who found out that women reported greater levels of anxiety about mathematics than men.

In addition, majority of both male (75.2%) and female students (83.7%) believed that their teachers were interested in their progress thus showing a positive attitude towards their teachers. This points out that a positive attitude by both male and female students towards teachers will in turn lead to a better achievement in chemistry. This is consistent with the works of Sofiani *et al.*, (2017) who noted that Students' attitude towards science varies among the students, depends on factors that are associated with the teacher, such as teaching methods, classroom management, and teachers' of knowledge of content and personality.

Furthermore, majority of both male (58.0%) and female (77.5%) students believed that they were encouraged by their teachers to study more chemistry. This implies that female students had a more positive attitude towards the encouragement that was provided by their teachers. In addition, majority of both male (70.7%) and female (68.2%) believed that they communicated with their teachers concerning careers that needed chemistry. This shows that male and female students had a

positive attitude towards careers that had chemistry even though male students had a more positive attitude than the female students.

One of the key factors in learning science is students' attitudes and the development of positive attitudes toward science can motivate student interest in science education and science-related careers (George, 2006).

Further, majority (52.2%) of male students believed that knowing chemistry would help them earn a living while majority (61.2%) female students believed otherwise showing that female students had a negative attitude towards the usefulness of chemistry. This concurs with studies by Majere, Role, & Makewa (2016) on self-concept, attitude and perception of usefulness of physics and chemistry according to type and location of schools which found out that difference in perception of the usefulness of Chemistry was statistically significant between students in urban schools.

Furthermore, majority (63.7%) of the male students believed that they needed chemistry for their future work while majority (57.4%) of the female students believed otherwise. This implies that female students had a more negative attitude towards importance of chemistry in their future work. This therefore shows that they tend not to make an effort to learn and understand the meaning of chemistry concepts that are being taught. It was shown that the most effective factor contributing to students' decisions to study science is their interest in the subject (Lindahl, 2003). Thus in this study female students showed negative attitude towards importance of chemistry thus affecting their performance.

Similarly, majority (76.4%) of the male students believed that chemistry is a worthwhile necessary subject while on the contrary, majority (60.5%) of the female students in the study area believed otherwise. The study shows that male students are more positive on the importance of chemistry but the female students attach no significance to chemistry.

This was found to concur with the findings of Barnes *et al*. (2005) in Australia which revealed that the attitudes of boys towards chemistry was more positive than were those of girls. This therefore shows that the negative attitude of girls towards the usefulness of chemistry plays a significant role in their performance.

The study further found out that all the three variables under attitude on this study (Confidence in Chemistry, Perception towards chemistry teachers and Usefulness of Chemistry) were all significant ($p \leq .05$). This shows that there was a significant difference between boys and girls in terms of attitude towards chemistry (Confidence in Chemistry, Perception towards chemistry teachers and Usefulness of Chemistry).

It further emerged from interviews conducted that despite majority of the girls having a negative attitude in chemistry as a subject, there are some bright girls who would want to take chemistry as a subject and are performing better than most boys in chemistry. This therefore shows that the negative attitude that is displayed by most girls towards chemistry is not a pointer that they cannot

outperform their male counterparts. In addition, observation conducted pointed out that most of the girls were taking chemistry as a subject in comparison to other science subjects like physics.

5.2.3 Effect of Teacher Interaction Styles on Secondary School Students' Achievement in Chemistry

The second objective of this study was to establish the effects of teacher interaction styles on secondary school students' achievement in Chemistry in Nandi North Sub-County. The study findings showed that majority (59.8%) of the students in secondary schools in Nandi North sub-county believed that female students taught through lecture method performed poorly in chemistry. This implies that the use of lecture method is not advisable for teaching chemistry and therefore other methods of teaching chemistry need to be devised and lecture method reduced or done away during chemistry instruction. This agrees with the findings of Colleen (2014) who found out that guided inquiry and partial guided-inquiry students had a statistically significant improvement in these grades over students taught by lecture method only. This therefore points out that lecture method is not a desired chemistry instruction mode.

Further, majority (63.3%) of the respondents noted that use of discussion groups enabled girls to improve on their performance in chemistry. This therefore shows that teachers need to use discussion groups as a way of instruction for girls as this is associated with improved academic performance. According to Robyn and Adrian (2003), one practice that has received widespread coverage over the past decades is

cooperative or small-group learning which according to Gillies and Boyle (2010) is a pedagogical practice that helps students to gain and create both academic and social relationships as well as to accomplish shared objectives.

In addition, majority (73.8%) of the secondary school students in Nandi North Sub-County reported that girls who guided by teachers both in practical and theoretical chemistry perform better in the subject. This implies that girls will only perform well in chemistry when they are well guided by their teachers. Practical work is thought to provide learners with evidence to support their understanding and to concretise scientific principles (Jormanainen, 2006). Thus, learners are exposed to basic processes of science through practical work.

Similarly, majority (69.6%) of the secondary school students in the study area were of the view that girls exposed to regular chemistry practical work performed better than those who have not been exposed to practical work. This therefore shows that students need to be exposed to practical work on regular basis so as to improve on their academic performance.

This is in line with other scholars, including Orora, et al. (2014) and Otuka and Uzoechi (2009). In their studies they have found that the poor performance and laboratory capacity of biology are influenced by no expository approaches to the objectives of biological education. Schools therefore need to be encouraged to follow pedagogical practices promoting active participation of the learning of students (Glomo-Narzoles, 2015).

In addition, majority (62.3%) of the students in secondary schools in Nandi North Sub-County believed that teachers who usually give feedback to students' responses enable girls to perform better in chemistry. This shows that timely feedback for students' work enables them to gauge their understanding of the subject and therefore improve on specific areas leading to overall performance in the subject. Kelly & Antonio, (2016) argued that one of the most significant measures of support for education is the input of educators.

Feedback basically provides students with perspectives on how or whether they perceive a particular subject (Andersson & Palm, 2017; Gielen, Peeters, Dochy, Onghena & Struyven, 2010). The purpose is to allow students to become auto-regulated learner by, for example, interpreting external feedback from teachers and generating internal feedback to monitor their current learning in relation to their learning objectives (Nicol & Macfarlane-Dick 2006).

In addition, the study found out that there was a significant difference between male and female students ($p \leq .05$) on effect of teacher interaction styles used in chemistry on secondary school students' achievement in the subject. This shows that various interaction styles favour girls than boys and vice versa therefore teachers of chemistry need to be aware on the best interaction style to use.

5.2.4 Influence of Availability of Teaching and Learning Materials on Secondary School Students' Achievement in Chemistry

The third objective of this study was to determine the extent of influence of availability of teaching/learning materials on secondary school students'

achievement in Chemistry. The study findings showed that majority (66.8%) of the secondary school students believed that there was no well-equipped chemistry Laboratories in their school thus making students not to be acquainted to laboratory techniques. This shows that secondary schools need to equip their laboratories in order to allow students to be acquainted with laboratory techniques thus improving on their performance in chemistry.

This study finding are similar to those of other researchers including Adeyemi, (2008) and Arokoyu & Ugonwa, (2012) amongst others who have reported that inadequate laboratory facilities was responsible for poor performance in the subject. The laboratory is an important tool to teach and learn chemistry. The Chemistry Lab, which plays such an important role, provides students a wide number of special facilities. The use of this entire facility allows the students to be highly trained.

In addition, majority (70.6%) of the students in secondary schools in Nandi North Sub-County reported that there were inadequate chemistry teachers in their schools. This is a pointer that secondary school students in the region lacked adequate instruction in chemistry thus hindering the performance in the subject. This therefore points out that there is need for the government to recruit more chemistry teachers in the study area so as to enhance learners' academic performance in chemistry. This study finding is in congruence with those of Boyd & Barbarin, (2008) who noted in their study that teacher adequacy can compromise the quality of education.

Similarly, majority (65.0%) of the form three learners in Nandi North Sub-County reported that they lacked adequate chemistry books in their schools thus affecting negatively their chemistry studies. This is in line with UNESCO report (2005) which pointed out that the large increase in the number of students without the addition of resources in the schools affected the quality of education.

Further, majority (72.8%) of the students believed that there were inadequate laboratory manuals and charts hindering proper utilization of laboratory equipment. This shows that students lacked laboratory concepts due to inadequacies in laboratory manuals and charts. Soetan et al. (2010) notes that maps, posters and illustrations clearly communicate information and ideas by incorporating diagrams, words and photographs.

In addition, majority (70.6%) of the students believed that classrooms in their schools were not adequate and spacious. This implies that public secondary schools in the study area were congested thus making the teaching and learning process to be difficult. This therefore shows that there is need for construction of more classrooms in the study area to ease congestion during the learning process. The increased enrolment in secondary schools due to Free Day secondary Education (FDSE) has led to increased number of students in a classroom. According to Yusuf (2015), classrooms are used as appropriate places for seeking and acquiring education usually from a teacher to the learners.

Though there were adequate resources for teaching Chemistry, the score for use was relatively low in Nandi County particularly with regard to audio visual

instructional materials. Inferentially, use of resources and facilities was found to impact positively on students' performance in Chemistry particularly performance of average students since students who scored between 45% and 59% registered the highest scores on the elements of attitude scale. In contrast, the significance of children in the effect of the provision of education and learning content on the achievement of secondary school pupils in chemistry ($p>0.05$) did not differ considerably. It was observed. It was also obvious. It indicates that both boys and girls were equally affected by the adequacy and accessibility of teaching and learning resources in their chemical results.

5.2.5 Perception of Teachers towards Teaching of Chemistry

The fourth objective of this research was to study the understanding of teachers in secondary schools in chemistry. The study showed that most teachers in less developed schools, particularly those with poor infrastructure, had a negative attitude to chemistry teaching. This is because most of these schools are without labs so that chemists are educated.

However, it also emerged that teachers in "big schools" or well-established schools had a positive attitude towards teaching chemistry. This is owed to the fact that they have adequate teaching resources, well equipped chemistry laboratories and are at advantages position of having a low student teacher ratio. This shows that teachers' attitude towards teaching of chemistry is dependent particularly on teaching and learning resources which are available in their schools.

Inability of students to do a realistic research results in an inductive method of studying the natural world and drawing conclusions is unable to do that as a result of teaching pupils the critical thinking skills (CAPS, 2011) The Chemical Curriculum in secondary school offers various examples of research which might be performed for every subject, but teachers end up not performing the necessary research because the tests are less so and they do not have laboratories to perform this practical component simultaneously (Moodley, 2013).

5.3 Conclusions of the Study

The following conclusions were made based on the study findings;

Based on the first objective of the study, it was concluded that there was a significant difference between boys and girls in terms of attitude towards chemistry (Confidence in Chemistry, Perception towards chemistry teachers and Usefulness of Chemistry). The negative perception towards chemistry negatively influenced girls' performance in the subject.

Based on the second objective of this study, it was concluded that there was a significant difference between male and female students ($p \leq .05$) on effect of teacher interaction styles used in chemistry on secondary school students' achievement in the subject. This shows that various interaction styles favour girls than boys and vice versa.

Based on the third objective of this study, it was concluded that there was no significant difference on the mean of boys and girls on influence of availability of teaching and learning materials on secondary school students' achievement in

chemistry ($p \geq .05$). This shows that the adequacy and availability of teaching and learning materials affects both boys and girls equally in their performance in chemistry subject. In cases where there are adequate teaching and learning materials for chemistry, girls will perform better in the subject.

Based on the last objective of this study, it can be concluded that teachers' attitude towards teaching of chemistry was dependent particularly on teaching and learning resources which were available in schools. Positive teaching attitude was associated with adequate teaching and learning resources while teachers' negative attitude was associated with lack of teaching and learning resources.

5.4 Recommendations of the Study

The following are the recommendations of this study;

i. The negative attitude displayed by most girls towards learning of chemistry affects negatively their performance. Therefore, teachers of chemistry need to encourage and motivate girls to develop a positive attitude toward the importance of chemistry as a subject.
ii. The study recommended that teachers of chemistry need to be aware of the best instructional strategies that motivate girls to like chemistry subject.
iii. There is need for the government and other education stakeholders such as parents and secondary school Parents Teachers Associations to provide adequate and relevant teaching and learning materials which motivates students to learn chemistry.

iv. There is need for secondary school Board of Management in various schools in the sub-County to facilitate the construction and equipping science laboratories so as to enable students to undertake practical part of sciences which is currently lacking. This will also motivate teachers to develop a positive attitude towards the teaching of chemistry.

5.5 Suggestions for Further Research

The following suggestions are made for further research,

i. There is need for a study on factors that contribute to negative attitude of girls towards learning of chemistry in secondary schools.

ii. There is need for a study on the moderating role of teachers' attitude towards teaching of chemistry on factors affecting the general performance of students in chemistry.

5.6 Chapter Summary

From data analysis in chapter four, the study isolated some factors which were found to be contributing to the persistent poor performance of female students in Chemistry in Nandi County.

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APPENDICES

APPENDIX I: LETTER OF INTRODUCTION

Bitok Norah Jelimo
University of Eldoret
P.O Box 1125
Eldoret

Dear Sir/ Madam,

RE: EDUCATIONAL RESEARCH

I am **Bitok Norah Jelimo** a student undertaking a Master of Education Degree at University of Eldoret. In order to complete this program, I am required to research and present a Thesis on the "**Factors Contributing to Poor Performance in Chemistry among Girls in Secondary School in Nandi North Sub-County, Kenya.** This research is purely for academic purposes and the information you give will be treated with confidentiality. Do not indicate your name anywhere on this questionnaire. I kindly request you to participate in my study and your responses to the items in the questionnaire. The results will not be used for any other purposes except this study. You are free to withdraw from participating in the study at any time.

Thank you

Yours faithfully

Bitok Norah Jelimo

APPENDIX II: STUDENTS' QUESTIONNAIRE

I am conducting a study entitled "**An Investigation of factors influencing the performance of girls in chemistry subject in secondary schools in Nandi North Sub-County, Nandi County"**. This is in partial fulfillment of the requirements for the Degree of Master of Education of the University of Eldoret. Your responses will be treated with strict confidence and the data will be used for research purposes only.

SECTION A: Demographic Description of participants (Tick where appropriate)

1. Please indicate your gender

(i) Male ☐

(ii) Female ☐

2. Type of school

(i) Girls ☐

(ii) Mixed ☐

(iii) Boys ☐

Section B: Students Attitude towards chemistry

Please indicate your agreement/disagreement on the following statements using the following key;

SD – Strongly Disagree D – Disagree UD - Undecided

A- Agree SA – Strongly Agree

STATEMENT	**SD**	**D**	**UD**	**A**	**SA**
Confidence about chemistry					
I am sure that I can learn chemistry					
I am sure of myself when I do chemistry					
I think I can handle more difficult chemistry questions					
Perception of towards teachers					
My teachers have been interested in my progress in chemistry					
My teachers have encouraged me to study more chemistry					
I would talk to my chemistry teacher about a career that uses					

chemistry					
Usefulness of chemistry					
Knowing chemistry will help me earn a living					
I will need chemistry for my future work					
Chemistry is a worthwhile necessary subject					

Section C: Effect of Instructional Methods on Girls' achievement in Chemistry

Statement	SD	D	UD	A	SA
Female students who are taught by teachers who rely on lectures perform better in chemistry					
Use of discussion groups enables girls to perform well in chemistry					
Girls who guided by teachers both in practical and theoretical chemistry perform better in the subject					
Girls exposed to chemistry practical work performance better than those who have not been exposed to practical work					

Section D: Influence of Instructional Resources on girls' achievement in Chemistry

Statement	**SD**	**D**	**UD**	**A**	**SA**
Our school has well equipped chemistry Laboratories making students to be acquainted to laboratory techniques					
There are adequate number of chemistry teachers in our school					
There are sufficient chemistry course books in our school					
The school has adequate laboratory manuals and charts for students					
There are adequate and spacious classrooms in our school					

APPENDIX III: INTERVIEW SCHEDULE FOR CHEMISTRY TEACHERS

I am conducting a study entitled "**An Investigation 0f factors influencing the performance of girls in chemistry subject in secondary schools in Nandi North Sub-County, Nandi County"**. This is in partial fulfillment of the requirements for the Degree of Master of Education of the University of Eldoret. Your responses will be treated with strict confidence and the data will be used for research purposes only.

1. School …….

2. Number of teachers of Chemistry in your school……..

3. Mean score for Chemistry as a subject in your school for the last four years ……

4. How does the attitude of girls towards learning of Chemistry in secondary school affect their performance?

……

……

……..

5. Which interaction styles do you use while teaching chemistry?

……

……

……..

6. To what extent do teacher interaction styles influence chemistry achievement in secondary schools?

……

……

……..

7. Are instructional resources (books, laboratories, charts) for teaching chemistry adequate in your school?

……
……
……..

8. To what extend does availability of teaching/learning materials influence secondary school students' achievement in Chemistry

……
……
……..

9. As a chemistry teacher, how do you perceive the teaching of chemistry?

……
……
……..

APPENDIX IV: CLASSROOM OBSERVATION SCHEDULE (COS)

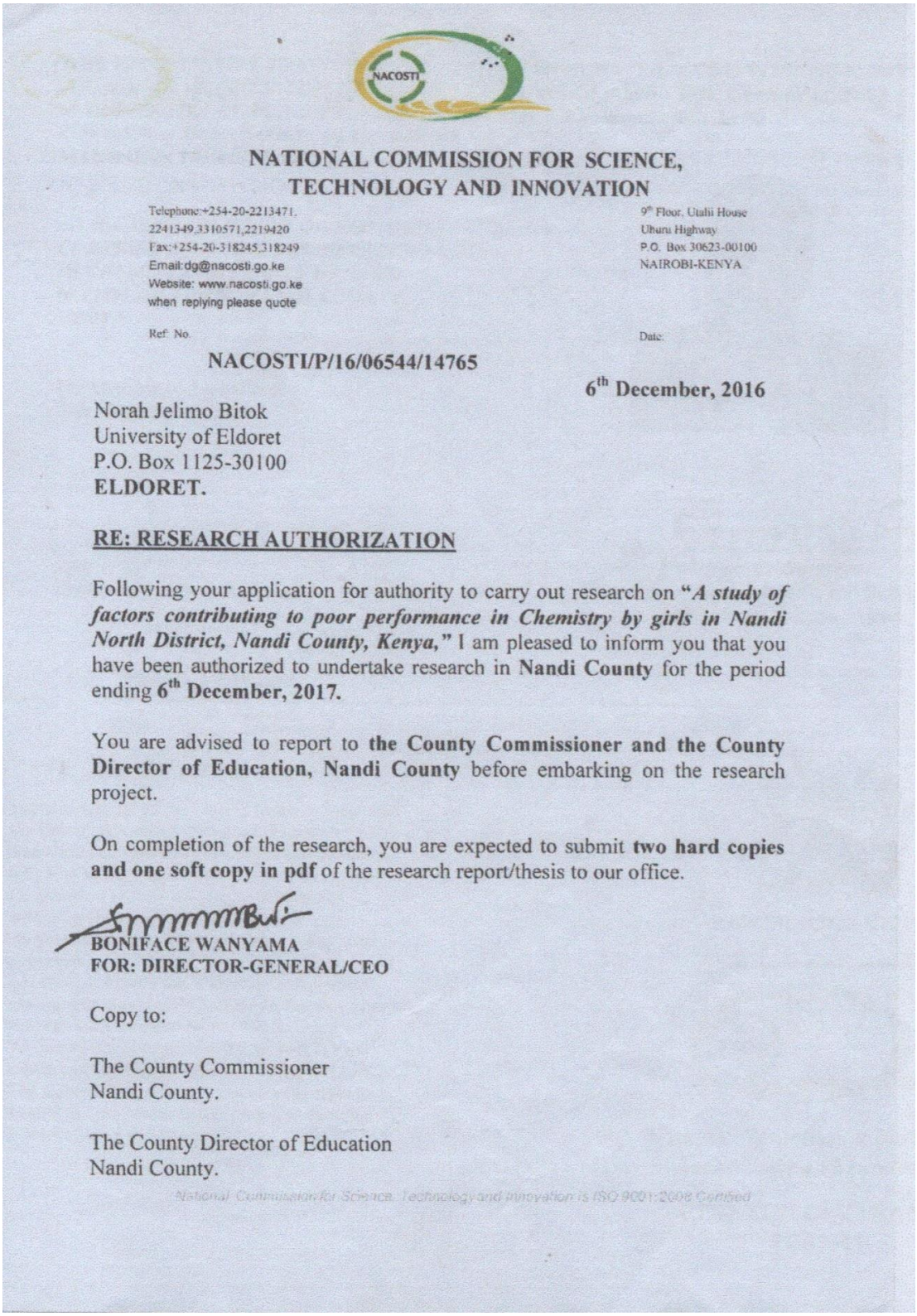
Class: _____ Date:_____

School type: _____

Chemistry Mean for the previous two Exam: _____

CATEGORY DEFINITION	Interaction styles	
	Tallies of Category Occurrence	Total Tallies
Teacher talk Praise and encouragement Clarification and development of ideas suggested by students Ask questions Answer students' questions Lectures Gives Feedback Gives directions Justifies authority Student Talk Responses emitted Ask questions Silence/Confusion		
TOTAL TALLIES		

APPENDIX V: RESEARCH AUTHORIZATION LETTERS



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email:dg@nacosti.go.ke
Website: www.nacosti.go.ke
when replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

Date:

NACOSTI/P/16/06544/14765

6th December, 2016

Norah Jelimo Bitok
University of Eldoret
P.O. Box 1125-30100
ELDORET.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"A study of factors contributing to poor performance in Chemistry by girls in Nandi North District, Nandi County, Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Nandi County** for the period ending **6th December, 2017.**

You are advised to report to **the County Commissioner and the County Director of Education, Nandi County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nandi County.

The County Director of Education
Nandi County.

National Commission for Science, Technology and Innovation is ISO 9001:2008 Certified

REPUBLIC OF KENYA

MINISTRY OF EDUCATION
STATE DEPARTMENT FOR EARLY LEARNING AND BASIC EDUCATION

Email: cdenandicounty@yahoo.com
When replying please quote

COUNTY DIRECTOR OF EDUCATION,
NANDI
P.O BOX 36 – 30300,
KAPSABET.

Ref:NDI/CDE/RESEARCH/1/VOL.II/143

25th February, 2017

Norah Jelimo Bitok,
University of Eldoret
P.O Box 1125-30100,
ELDORET.

RE: RESEARCH AUTHORIZATION.

The above named person has been granted permission by the County Director of Education to carry out research on "***A study of factors contributing to poor performance in Chemistry by girls in Nandi North Sub County in Nandi County***" **Kenya** for the period ending **6th December, 2017**

Kindly provide her all necessary support she requires.

For: County Director of Education
NANDI COUNTY

Ondara Evans,
For: County Director of Education,
NANDI COUNTY.

THE PRESIDENCY

MINISTRY OF INTERIOR AND COORDINATION OF NATIONAL GOVERNMENT

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

Ref: No. NC.EDU/4/1/VOL.V(114)

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

25th February 2017

Norah Jelimo Bitok
University of Eldoret,
P.O. Box 1125 - 30100
ELDORET.

RE: RESEARCH AUTHORIZATION

This is in reference to letter No. NACOSTI/P/16/06544/14765 dated 6th December, 2016 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 **"A study on factors contributing to poor performance in Chemistry by Girls in Nandi North Sub County, Nandi County"** for the period ending **6th December 2017.**

Wishing you all the best.

THE COUNTY COMMISSIONER NANDI.

JARED O. OWINO,
For: COUNTY COMMISSIONER,
NANDI.

APPENDIX VI: RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MS. NORAH JELIMO BITOK
of UNIVERSITY OF ELDORET, 1125-30100 Eldoret,has been permitted to conduct research in *Nandi County*

on the topic: *A STUDY OF FACTORS CONTRIBUTING TO POOR PERFORMANCE IN CHEMISTRY BY GIRLS IN NANDI NORTH DISTRICT, NANDI COUNTY, KENYA*

for the period ending:
6th December,2017

Permit No : NACOSTI/P/16/06544/14765
Date Of Issue : 6th December,2016
Fee Recieved :Ksh 1000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officer will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one (1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEACH CLEARANCE PERMIT

Serial No.A 12181

CONDITIONS: see back page

APPENDIX VII: MAP OF THE STUDY AREA

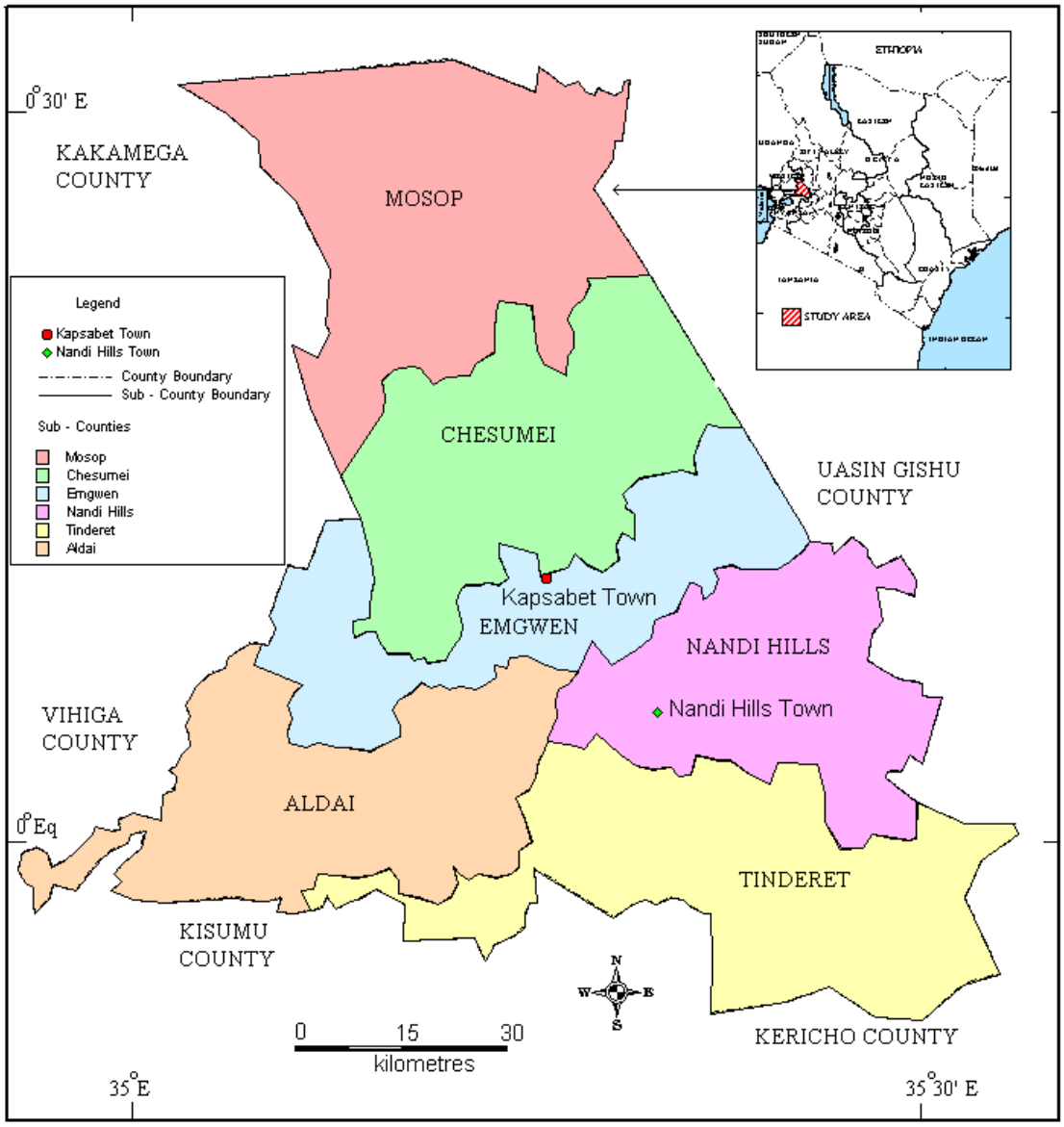
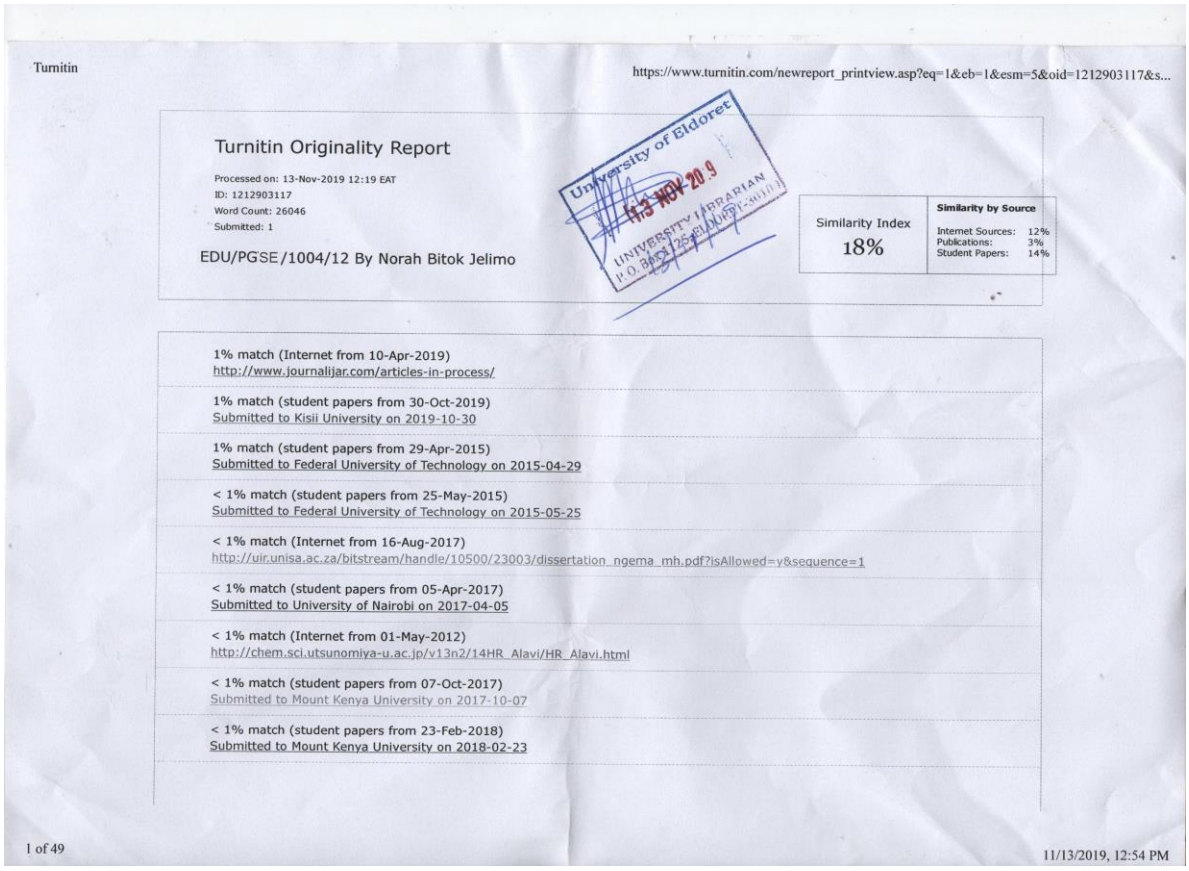


Figure 1: Map of Nandi County showing the sub – counties as the study area.

APPENDIX VIII: SIMILARITY REPORT



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