GENDER DIFFERENCES IN THE RELATIONSHIPBETWEEN STUDENTS' ATTITUDE TOWARDS CHEMISTRYCURRICULUM AND ACHIEVEMENTIN SECONDARY SCHOOLS IN MATAYOS SUB-COUNTY, KENYA

BY

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SCHOOL OF EDUCATION

MASENO UNIVERSITY

DECLARATION

By Student:

This thesis is my own work and has not been presented to any University for the award of any degree. Where other peoples' work has been sought, this has been properly acknowledged and referenced in accordance with the Maseno University requirements.

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DEDICATION

This thesis is dedicated to my late sister Beatrice Gladys Wanzala who inspired me to the world of determination and to my son Ryan Vicker who inspires me to work hard and go beyond limits.

ABSTRACT

Chemistry is one of the essential science subjects in most scientific courses at the university level. From the year 2013 to 2016, analysis of the chemistry results in the Kenya Certificate of Secondary Education (KCSE) by gender showed the mean scores attained by boys as 2.11 (2013), 2.09 (2014), 1.86 (2015) and 2.61 (2016) while that of girls was1.20 (2013), 1.18 (2014), 1.23(2015) and 1.56 (2016) out of the total mean of 12.00 points, in Matayos Sub-County. The results show gender differences in performance in the subject. Studies on the relationship between Students' Attitude towards Chemistry and Achievement in the subject have been conducted in Matayos Sub-County, but no known study in the Sub-County has established gender differences in the relationship between students' attitude towards chemistry curriculum components and academic achievement in the subject. The purpose of this study therefore was to establish gender differences in the relationship between students' attitude towards chemistry curriculum components and academic Achievement in secondary schools in Matayos Sub-County, Kenya. The objectives of this study were to establish gender differences in the relationship between students' attitude towards Chemistry: objectives, content, methods, evaluation, and Academic achievement in chemistry. In the conceptual framework, independent variable was students' attitude towards chemistry curriculum objectives, content, methodology and evaluation while the dependent variable was Achievement in chemistry. Both descriptive survey and correlation research designs were employed. The target population was 900 Form 4 students from all the 14 secondary schools in the Sub-County. The sample size of 269 students (130 girls and 139 boys) was obtained by Krejcie and Morgan formula. Research instruments used to collect data were Students' Attitude Questionnaire (SAQ), Students' Interview Schedule (SIS), and Document Analysis Guide (DAG).Reliability of the students' questionnaire was determined using Crobanch's alpha formula. For validity, the instruments were presented to experts from Department of Educational Communication, Technology and Curriculum Studies, Maseno University for scrutiny and examination. Descriptive statistics (means, frequency counts and standard deviations) and inferential statistics (t-test and Pearson's, r and regression analyses) were used for analysis of quantitative data. Qualitative data was transcribed and reported in an on-going process as themes and sub-themes emerged. The study established that there was gender difference in the relationship between students' attitude towards chemistry objectives and achievement(p <.05).There was no gender differences in the relationship between students' attitude towards chemistry content and achievement,(p> .05). Similarly, there was no gender difference in the relationship between students' attitude towards chemistry methods and achievement, (p >.05).Gender difference in the relationship between students' attitude towards chemistry evaluation and achievement was statistically significant (p< .05). The study therefore recommends that teachers need to inculcate the importance of the objectives of studying chemistry to learners as some learners were not aware of the role and the importance of chemistry in their carrier choice and even their daily lives. Teachers need to help girls demystify that some of the topics in the chemistry course are difficult, since gender does not moderate the relationship between attitude towards chemistry content and achievement. There is need for teachers to ensure that both boys and girls get equal opportunities to participate during lesson instruction, as there is no gender difference in students' attitude towards chemistry methods and achievement. Teachers need to put proper evaluation strategies to prepare learners adequately to tackle the KCSE examination. There is need to motivate them to change their attitudes positively as there exists gender difference in the relationship between students 'attitudes towards chemistry evaluation and achievement.

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LIST OF ABBREVIATIONS AND ACRONYMS

KNEC	:	Kenya National Examination Council
K.C.S.E	:	Kenya Certificate of Secondary Education
SMASSE	:	Strengthening of Mathematics and Sciences in Secondary Education
UNEB	:	Uganda National Examinations Board
ROK	:	Republic of Kenya
STEM	:	Science Technology Engineering and Mathematics
SPSS	:	Statistical package for social sciences
CAIF	:	Chemistry Attitude Influence Factors

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CHAPTER ONE
INTRODUCTION

1.1 Background to the Problem

Women are under-represented in science, technology, engineering and mathematics (STEM) related fields and this remains a concern for educators and the scientific community. Gender differences in mathematics and science achievement play a role, in conjunction with attitudes and self efficacy beliefs (Reilly, Neumann and Andrews, 2019). Halpern (2000), Lippa (2002), and Cahill (2005) argue that there could be differences between the male brain and the female brain and also differences in the sex hormones which influence the skills in males differently from that of females. While the gender gap in STEM achievement may be closing, there are still large sections of the world where differences remain (Reilly, Neumann & Andrews, 2019).

Dalton (2008) reported that the number of women who pursuea post-secondary degree in science are more than men hence many do not enroll into Engineering, Science, Maths and Technology related courses. Larrondo-Petrie, (as quoted in Green,2009) "What is turning girls off is the image of an engineer. They don't see engineering in relation to its impact on the world, society, on the human condition". Green (2009), Ingels and Dalton (2008) in their studies reveal factors which perpetuate differences in science achievement of males and females. These include subjects done in high school, the support they get from role models, parents and even teachers and the general attitude held by females in science. (Ingels& Dalton, 2008, National Science Foundation, 2005, Green,2009).

A study by Can (2012)reveals differences in gender on issues related to importance of chemistry and its enjoyment among children aged ten and eleven years. Barnes, Mclnerney and Marsh (2005) investigated gender differences regarding chemistry enrolment interests shown by students studying in Sydney, Australia. The study found out that female students did not find chemistry as interesting as males (Barnes *et al*.,2005).While these studies reveal gender differences in the relevance and students' interests regarding chemistry, their attitudes towards the subject remains unknown.

Ssempala (2009) carried out a study to determine if there were gender differences in performance of chemistry in practical skills among students in Uganda. He reports that girls performed slightly lower than boys in interpreting, computing, analyzing recording and even reporting, hence the reason as to why boys perform better than girls in chemistry practicals in the Uganda National Education Board (UNEB). The study by Ssempala (2009) invoved only

the practical chemistry examination while ignoring the theoretical part, hence may not present a true picture of the general chemistry performance. The current study examines the general chemistry achievement in both practical and theoretical examination papers. Other studies that have shown higher performances of boys than girls in chemistry include; Cheung (2009), Osborne and Dillon (2008), Kubiatko, Balatova, Fancovicova and Prokop (2017). The researchers however did not provide reasons for such differences in performance, hence the current study in Matayos Sub-county sought to investigate gender differences in chemistry achievement.

In Kenya, Busolo (2011) revealed that gender was strongly associated with chemistry achievement; the interest and affinity towards chemistry was stronger in boys than in girls. This study was conducted in Kakamega County; there is therefore the need for the same study to be done in other counties to ascertain those findings. Busolo (2011) study also sought to determine factors which contribute to gender differences in chemistry achievement, while this research emphasizes on gender differences in the relationship between attitude and achievement in chemistry which the former study does not address.

To be able to support the achievement and the interests of students towards a subject, one needs to understand their attitudes (Yunus& Ali, 2013). According to Whitley (2010), 'attitude is an expression of favour or disfavour towards a phenomenon. It is learned tendency to evaluate things in a certain way'. This evaluation may involve events, issues, people or even objects, and are deemed more often than not negative or positive, but at times they could also be uncertain. Teachers have argued that attitude plays a profound role in the attainment of a person's goals, and failing in a particular subject may invoke feelings that are negative (Macias 2010; Kanafiah & Jumadi, 2013).

Chemisty curriculum assessment encompasses psychomotor, cognitive and even affective domains. Attitude being one of the affective domains is very important in academic performance, thus it is necessary for one to develop attitudes that will positively influence achievement in chemistry (Cheung, 2009).

Brickman and Lovelace (2013) allude that students' attitude largely impact on learning hence the development of these attitudes towards chemistry is very critical to science education. Khan and Ali (2012) and Nadji (2013) among others did an evaluation of the need of students to have positive attitudes towards the studying of chemistry. It was revealed that there is a

direct link between attitude and achievement in academics, hence conclude that attitude predicts one's behavior.

Positive attitudes develop in the early stages of development from infancy to adulthood. These attitudes however keep on changing throughout one's schooling, and in fact as the case of chemistry, they keep on decreasing. This is attributed to students losing interest in the subject gradually as they progress from one year to the next. These may also be orchestrated by experiences of failing among others(Vazquez & Manassero, 2008; Potrin & Hasni, 2014).In his research between gender, the year group and their influence on attitude towards chemistry Cheung (2009)noted that female students did not enjoy theoretical chemistry lessons as did the males in their early two years of secondary education. However, in the last two years, the liking for chemistry practical work by the male students declined to the extent of equaling that of the females. On the other hand, the liking of chemistry among the female students gradually increased throughout the years until the final year when it finally declined. These findings point out clearly the need to develop positive attitudes and sustain them as such. Hofstein and Naaman (2011) argue that one of the major goal in learning and teaching of chemistry is the development of interests and positive attitude towards science. Consequently, all the education stakeholders and members of the society in general need to take full responsibility in improving the attitude of students towards science. This will enable them live in a society that is highly technological and scientific in nature, which will spur its development both locally and globally. As Ungar (2010) puts it, "The future of our society will be determined by citizens who are able to understand and help shape the complex influences of science and technology on our world"

Several researches on attitude towards sciences and chemistry in general have shown that indeed attitude has a great influence on performance in chemistry. These researches have however shown that attitude is influenced by a number of factors. Some researches point out teachers, others learners, while others point to the chemistry syllabus itself among some of the factors that could be influencing attitude. In their study, Anwar and Bhutta (2014) reveal that the socio-cultural content that students explore, say for example the neighbors they interact with, family members and friends may determine their attitude towards science subjects.

The findings of Yunusand Ali (2013) in Malaysia reveal that quite a number of students display negative attitude towards chemistry since they prefer other subjects to chemistry. This

could be due to the difficult nature of some chemistry components together with its abstract nature. George (2006); and Said et al., (2016) observe that attitude towards science and one's age are inversely proportional, that as a person's age increases, the attitude decreases gradually. This is synonymous with the curriculum content in science. The primary school science curriculum forms the foundation of the secondary school curriculum. The primary school science curriculum deals with simple aspects such as the human body, nature and the environment. In contrast, the secondary school science projects the abstract nature of science hence attracting higher levels of thinking. The above findings are similar to those of Can (2012), who point out that as students progress from lower levels to higher levels, their attitudes decrease due to introduction of content that is more abstract which is distantly related to the usual occurrences in everyday life (Can, 2012).In his study, Jegede (2007) reveals that students show low levels of motivation in learning of chemistry. He attributes this to difficulty of the chemistry course among other factors. It is therefore important to look into the various factors which seem to modulate attitude and address them in lieu of different levels of education and culture (Montes, Ferreira & Rodriguez, 2018).

Astudy by Narmadha and Chamundeswari (2013)reveals a relationship which exists between learning, science academic achievement and attitude among secondary school students. In another study, Ali and Awan(2013) investigated the relationship between students' attitude towards science and academic achievement in chemistry, mathematics, physics and biology among students in secondary schools, and it revealed a positive relationship. The studies by Narmadha and Chamundeswari (2013); and that by Ali and Awan(2013) investigated attitude towards students' achievement in science in general, the current study seeks to investigate gender differences in the relationship between attitude towards chemistry and achievement in the subject.

In Turkey, Kahveci (2015) reported that students' attitude towards chemistry were neutral. The study reveals however, that students who performed dismally displayed low positive attitude than those who had high marks. In Jerusalem, a study done by Najdi (2013) revealed negative attitude of students towards the subject. In Chile, a study by Montes, Ferreira and Rodriquez (2018) revealed similar findings. The above studies carried out worldwide reveal mixed findings on attitude, hence need for the current study.

Ijidike (2015) recognizes that chemistry contributes greatly to the body of knowledge and its prominence in the secondary education curriculum as a subject has been recognized globally.

According to Ituma (2012), chemistry knowledge is important as it is useful in areas such as synthesis of quality goods and service provision. Njagi, and Silas (2015) and Mwangi (2016) report that chemistry is a major requirement for one to enroll into scientific related careers like engineering, biotechnology, medicine, pharmacy among others in many universities and colleges. It is also a prerequisite for enrolment into scientifically inclined carriers such as medicine, engineering, pharmacy, biotechnology, agriculture and the like, in post-secondary educational institutions.

In Kenya, learners are introduced to chemistry in secondary schools. However, chemistry is also taught at primary school level, where some aspects are integrated in the primary science (Ituma, 2012). The chemistry taught at primary school involves simple aspects such as the human body and the natural environment, while the secondary school one involves more complex and abstract phenomena which requires higher thinking capacity (Said, Summers, Abdi-El- Khalick & wang, 2016 and George, 2006).Chemistry performance in the Kenya Certificate of Secondary Education (KCSE) has consistently remained lower compared to the two other science subjects that is, Physics and biology, despite the emphasis placed on the importance of chemistry knowledge in the academic realm (Muse, 2017; KNEC, 2005). The low performance of Chemistry in national exams may be a sign that the objectives for teaching the subject are not being met. This is a concern for the government, parents, educators and all stakeholders. If performance in the National examinations is not satisfactory, then it can be assumed that little learning is taking place. The comparative KCSE mean scores in chemistry for Busia County is shown in Table 1.1.

Table 1.1: KCSE Chemistry mean scores for Busia County from the year 2013 to 2016

Sub County	2013	2014	2015	2016
Bunyala	5.56	4.824	5.30	4.478
Nambale	4.810	5.621	5.208	4.963
Butula	5.258	4.008	5.001	5.427
Teso North	4.631	5.301	4.108	3.905
Teso South	4.017	3.89	4.41	4.811
Matayos	3.312	3.272	3.094	3.693
Samia	4.665	4.891	5.01	5.283

(Source: Busia County Educational Statistics, 2017)

From the Table1.1 above, Matayos Sub-County has shown the lowest trend in the mean score compared to the other six Sub- Counties. This trend has far reaching repercussions as far as chemistry subject is concerned. The subject has also shown a backward trend in comparison

with its two other science subjects, that is, Biology and Physics in Matayos Sub-County from the year 2013 to2016 as shown in Table 1.2.

Table 1.2: K.C.S.E Mean scores for Biology, Chemistry and Physics for Matayos Sub- County

Year	2013	2014	2015	2016
Biology	5.264	5.552	4.684	4.163
Chemistry	3.312	3.272	3.094	3.693
Physics	4.750	4.281	4.432	4.825

(Source: Busia County Educational Statistics, 2017)

Based on the above table, Biology recorded the highest mean scores ranging from 4.163(2016) to 5.552 (2014). This was followed by Physics which recorded a mean ranging from 4.281 (2014) to 4.825 (2016). Chemistry recorded the least performance with mean scores ranging from 3.094 (2015) to 3.693 (2016). Chemistry like any other subjects is graded nationally on a 12-point scale. A score of 3.693 in chemistry is to way below average mean.

Girls recorded a lower performance than their male colleagues, according to analysis of performance by gender. The results of the K.C.S.E mean scores out of the total 12 points by gender from the year 2013 to 2016 are shown in Table 1.3.

Table 1.3: K.C.S.E chemistry means scores by gender from the year 2013 to 2016

YEAR	GENDER		TOTAL
	Boys	Girls	
2013	2.112	1.20	3.312
2014	2.092	1.18	3.272
2015	1.864	1.23	3.094
2016	2.61	1.56	3.693

(Source: Busia County Educational Statistics, 2017)

Referring to Table 1.3 above, girls recorded lower performances across the years as compared to their male counterparts. This consistence low performance is what prompted this research in the Sub-County.

1.2 Problem Statement

Poor Chemistry grades prevent students from enrolling in professional programs including engineering, pharmacy, veterinary medicine, and medicine. Although the then Minister for Education in Kenya announced an improvement in the subject performance in the year 2016, schools in Matayos Sub-County are still under performing in the subject. The Sub- County

has recorded low mean Scores for the past four years (2013 to 2016) in the Kenya Certificate of Secondary Education, as shown in Table1.1. Out of these, girls have recorded the lowest mean scores as compared to boy as shown in Table 1.3. This low performance may hinder girls from pursuing the said courses competitively with boys. In light of this, the researcher attempted to determine whether there were gender differences in the relationship between students' attitudes toward the objectives of teaching chemistry, the content, the teaching and learning methodologies, and the evaluation strategies used in these processes, and whether these attitudes affected students' achievement in chemistry across secondary schools in Matayos Sub-County, Busia County, Kenya.

1.3 Purpose of the Study

This study investigated gender differences in the relationship between students' attitude towards chemistry and achievement in chemistry in secondary schools in Matayos Sub-County, Kenya.

1.4 Objectives of the Study

The objectives of the study were;

i. To establish gender differences in the relationship between students' attitude towards chemistry objectives and achievement in Chemistry.
ii. To establish gender differences in the relationship between students' attitude towards chemistry content and achievement in Chemistry.
iii. To establish gender differences in the relationship between students' attitude towards chemistry methods and achievement in Chemistry.
iv. To establish gender differences in the relationship students' attitude towards chemistry evaluation strategies and achievement in Chemistry.

1.5 Research Questions

The following research questions served as a guide for the study:

i. What is the gender difference in the relationship between students' attitude towards chemistry objectives and achievement in chemistry?
ii. What is the gender difference in the relationship between students' attitude towards chemistry content and achievement in chemistry?
iii. What is the gender difference in the relationship between students' attitude towards chemistry methods and achievement in chemistry?

iv. What is the gender difference in the relationship between students' attitude towards chemistry evaluation and achievement in chemistry?

1.6 Significance of the Study

Chemistry teachers may use the findings to improve achievement in chemistry by improving their teaching methodology, and evaluation techniques to be employed to realize effective teaching and learning processes. The results may also enable the teachers, parents/ guardians to assist learners to develop and maintain favourable attitudes as the results of this study reveal that there is gender differences in the relationship between attitude towards chemistry objectives and chemistry evaluation achievement in the subject.

1.7 Assumptions of the Study

The following assumptions served as the basis for this study:

i. That the respondents gave their honest opinions regarding their attitudes towards chemistry.
ii. Students' attitude towards chemistry is an important factor that affects chemistry achievement regardless of their entry behavior, family background and school culture.
iii. That the entry behavior at secondary school level is equal to both gender in the Sub-County.

1.8 Scope of the Study

This study focused on gender differences that existed in the relationship between attitude towards chemistry (objectives, content, methods, evaluation) and achievement in chemistry among secondary school students in Matayos Sub-County, Busia County. The study covered all the schools in the Sub-County. The study was only conducted with form four students because they had adequately covered the secondary Chemistry curriculum.

1.9 Limitation of the Study

There is a weakness in the use of questionnaires as a research tool because the respondents have a propensity to exaggerate or minimize their answers in order to get the outcomes they deem desirable. To control this, the Likert-type items were stated both negatively and positively to minimize the tendency of students forming a particular pattern while answering questions.

1.10 Conceptual Framework

This study examined the relationship between students' attitude towards Chemistry curriculum elements (objectives, content, methods, and evaluation) and Achievement in chemistry. The independent variable was students' attitude towards chemistry curriculum as revealed by attitude towards chemistry objectives, attitude towards chemistry content, attitude towards chemistry methods, and attitude towards chemistry evaluation. The dependent variable was students' achievement in chemistry as measured by K.C.S.E of 2017.The students' gender moderates a relationship between attitude towards the chemistry elements and academic achievement. The conceptual framework is shown in Figure1.1.

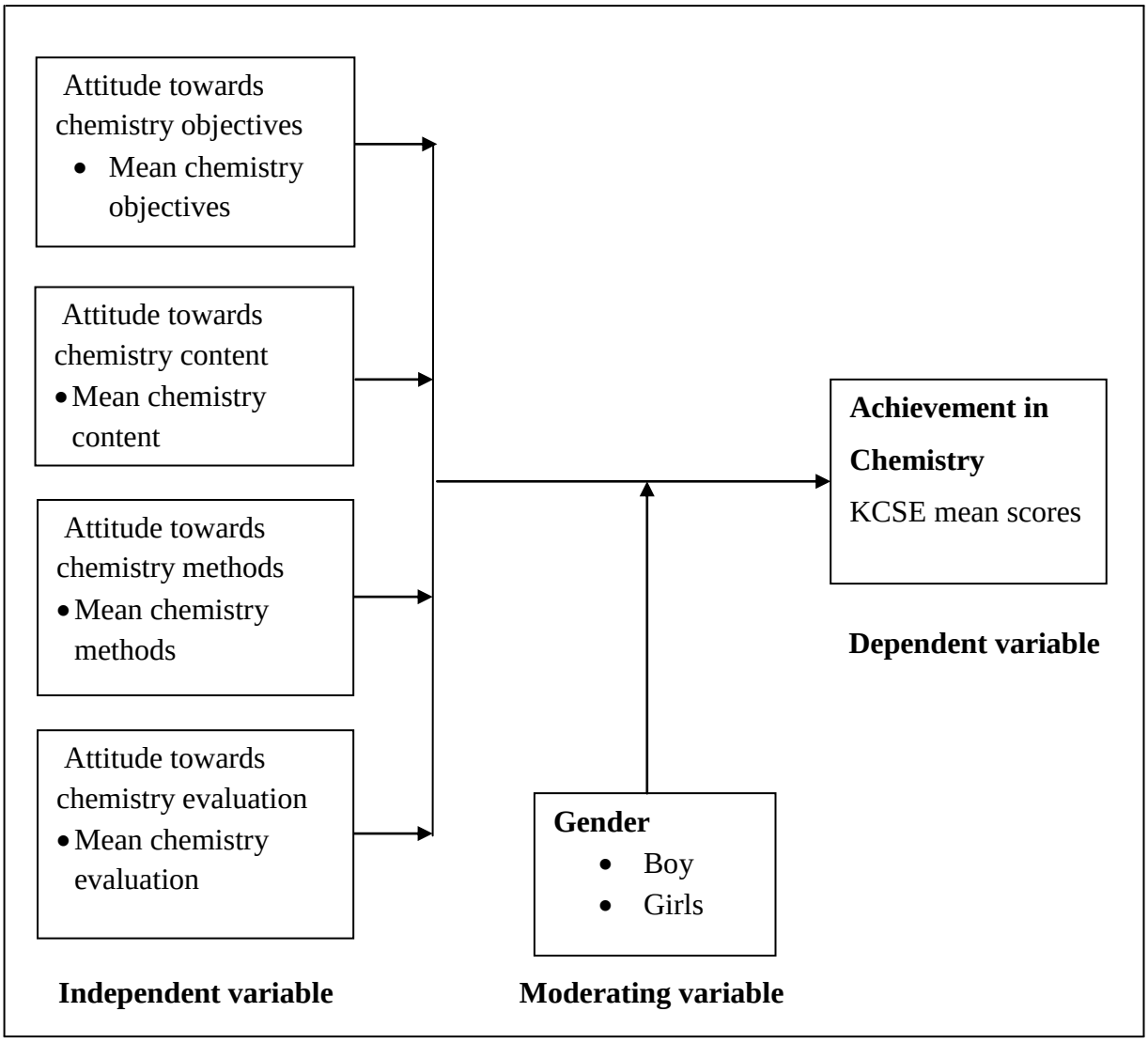

Figure 1.1: Conceptual Frame work on Students' attitude towards Chemistry objectives, content, methods, evaluation and Chemistry Achievement.

Attitude refers to students' inclinations towards the chemistry curriculum. The attitude could be positive, negative or neutral. When students have positive attitude towards the Chemistry curriculum, it is expected that this will positively influence their achievement. On the contrary, when there is negative attitude among students towards the chemistry curriculum, there will be negative impact on their achievement.

One aspect that has long caught the interest of experts is how students feel about learning the subject of chemistry. According to Adekosan, it is clear that students still have a negative feeling about the subject, which results in subpar performance and low enrollment even though it has been given more recognification above other science subjects (Adekosan,2002).

Chemistry curriculum is divided broadly into four elements: Objectives; Content; Methodology; and Evaluation. Objectives are specifications of intent for learning. The selection and structuring of the experiences for learning is based on the objectives. For good performance in chemistry to be realized, the set objectives should be realized by the time one clears the secondary school curriculum.

Content of the curriculum denotes body of knowledge. Posner (2008) notes that the forms of representation of the important ideas in the subject matter are important because they have implications both for what content is taught and how well it is taught. Therefore, the way the content is taught may have an effect on the students' performance. Kituku (2004) states that topics and sub- topics should be arranged in a logical order to allow for logical flow of content.

Methods encompass learning and instructional strategies. It involves organization of the said strategies. Learning is aided by adaptable teaching strategies. The accurate use of a teaching strategy whose activities focus on the majority of learning senses is a necessary component of effective chemistry teaching and learning. Technically speaking, good teachers provide the best opportunities for learning, but effective learning and student accomplishment are also enhanced by instructional strategies that encourage students to use their vision, hearing, and minds (Sogomo, 2001). Balozi and Njugune (2004) found that most lessons are conducted through lecture method with very little or no participation by students, which leads to poor results in KCSE examinations.

The last element of the curriculum is evaluation. It is the process of obtaining data and using reliable and valid instruments to judge the worth, value or quality of an educational entity. Evaluation provides data and ideas that instructors, teachers, students, parents and other education stakeholders can use.

When students have positive attitude towards chemistry curriculum elements (objectives, content, methods, evaluation) this may culminate into learners academic achievement in the subject. On the contrary, when learners have negative attitude, this may affect the learners negatively thus contributing to dismal academic achievement.

Gender is the variety of traits relating to and contrasting masculinity and femininity. The students' gender affect their attitudes towards chemistry objectives, content, methodology and evaluation. This in turn affects their academic achievement in the subject.

1.11Operational Definition of Concepts and Variables

Achievement-Refers to quantitative measure of students' chemistry scores at Kenya Certificate of Secondary Education.

Attitude- Refers to students' scores on attitude scale towards chemistry curriculum objectives, content, methodology and evaluation, categorized as positive, negative or neutral.

Chemistry curriculum components- Refers to the objectives, content, methodology and evaluation strategies used in teaching and learning of Chemistry.

Content- Refers to the body of knowledge encompassing the chemistry curriculum.

Evaluation- Refers to chemistry formative and summative assessments.

Gender differences-These are differences as a result of being either male or female arising from social and cultural construction of roles associated with these sex differences

Mean attitude- Is the mean of student' scores in chemistry curriculum components as measured by the attitude scale.

Objectives- Are specifications of intent for learning chemistry.

CHAPTER TWO
LITERATURE REVIEW

2.1Introduction

The literature review has been discussed in line with the objectives of the study. It comprises of four sections. Section 2.2 deals with gender difference in the relationship between students' attitude towards chemistry objectives and achievement. Section 2.3 deals with gender differences in the relationship between students' attitude towards chemistry content and achievement. Section 2.4 deals with gender differences in the relationship between students' attitude towards chemistry methods and achievement, while section 2.5 discusses gender difference in the relationship between students' attitude towards chemistry evaluation and achievement

2.2 Gender difference in the relationship between students' Attitude towards chemistry objectives and Achievement

Gender inequality is a major topic, particularly for academicians and those who create policy. The role of men and women in the political, religious, psychological, social, economic, religious, scientific, and technical development of countries is a concern among intellectuals (Igbudu, 2015).Despite significant progress achieved by women in the fields of law, medicine, and social sciences, relatively few work in graduate programs or in the fields of physics, computer science, information technology or engineering (Eccles, 2001).

Using data from four hundred and forty-nine students in their 10^{th} year from five high schools in Sydney, Barnes, Mclnerney and Marsh (2005) investigated the sex differences in enrollment intentions. Students' interest in chemistry was gauged using three different items, and the researchers found that men were more interested in the subject than women were. Five hundred and seventy-sixhigh school students in Greece were investigated by Salta and Tzougraki (2004) using an attitude scale with four subscales: difficulty of the chemistry course, interest in the course, utility of the course for students' future careers, and value of the course for students' lives. They did not find any variations between the perspectives of male and female students toward the interest, value, and significance of chemistry. These studies were carried out in Australia and Greece respectively, thus the need for a current study that is adopted to the Kenyan situation in order to ascertain the findings.

Numerous studies have been done on students' perspectives on science. The attitudes of students towards science have been extensively studied. The subject of gender disparities in

attitudes toward science has been the main focus of earlier researches. Most research shows that boys record a more favorable attitude toward science than girls do (Howe & Rua, 2000). According to the KNEC (2005), performance in Mathematics and science in KCSE has consistently been poor. Historically, these subjects have been considered to be difficult and for that reason many students have shied away from them.

A survey conducted by Banya (2004) involving 183 high school female students selected across the United States, students were asked about how their attitudes towards chemistry were influenced by their self-confidence, role models, and understanding of the subject's benefits. The schools were chosen at random to represent various economic and geographic backgrounds. Data on the impact of self-confidence toward chemistry, the influence of role models, and knowledge about the value of chemistry on their decision to study chemistry were gathered using the Chemistry Attitude Influence Factors (CAIF) instrument and from interviews which were focused on students in a group of three young females. To better understand the perspectives of the young female students, both quantitative (a Likert-type scale questionnaire) and qualitative (open-ended questions) elements were used. The study reported Significant differences in Likert-type scale scores, supplying evidence in support of the literature that asserts self-confidence toward Chemistry, role models' influence, and knowledge about the importance of Chemistry influence the decision of the female students to pursue Chemistry. The above study focused on the opinions of the female students only, while the current study investigates the gender interactions on the students' attitudes towards chemistry objectives and their achievement in the subject.

A study done by Cokadar and Kulce (2008) investigated pupils' attitude towards school science. They administered questionnaires to five hundred and three pupils in six public schools in Turkey. The study's findings indicated that students' attitudes toward science were moderate. There is a relationship between the school attended, pupils' favorite subject, families' monthly income, grades attained, the feeling of self- achievement and attitude of pupils towards science. The students' opinions toward science vary based on their preferred subject, where they went to school, what grade they were in, how much money their family made each month, and how successful they felt they were. Contrarily, there were no appreciable changes in the students' attitudes about science in relation to gender, the educational and employment status of their parents, or their own social self-perception. Cokar and Kulce's study investigated students' attitude towards science in general, the current study

investigates gender differences in the relationship between attitude of students towards chemistry and achievement.

Research on Attitude and Self-Efficacy as Affective Factors that influence chemistry achievement and the power of the factors to predict chemistry achievement was conducted by Kan and Akbas (2006).Their goal was to ascertain the students' attitude and level of self-efficacy toward chemistry and to investigate the influence of these variables on chemistry accomplishment (or, more specifically, how the achievement in chemistry was predicted by these variables). The research was carried out in 10 high schools involving 1000 students in the 1stthroughto the3rd grade in Mercin city. Descriptive statistics, correlation, linear and multiple regression were used in the analysis of data. The research showed that attitude towards chemistry predicted significantly to chemistry performance. This study did not however analyze the gender influence on students' attitude.

In their research carried out to establish school pupils' attitudes towards chemistry, Kubiatko, Fancovicova and Prokop (2017) examined grade level and gender. Nine hundred and thirty-one students from Czech lower secondary and secondary grammar schools made up the sample size. There were 25 Likert scale items in the questionnaire. The questions were divided into four groups using factor analysis: chemistry's popularity and difficulty; its relevance; chemical aids and laboratory experiments; and chemistry's role in future life. The final score revealed that students' attitudes toward chemistry were generally neutral or somewhat positive. With the exception of first grade in secondary grammar schools, girls scored worse than boys in every grade. In the secondary school students, girls scored marginally higher on attitude. The study conclusions reveal that it is feasible to assert that unfavorable attitudes toward chemistry exist among lower secondary and secondary grammar school students, implying the importance of attempting to better students' attitudes in chemistry in their early years of schooling. The above study examined the interaction of students' attitudes and their grade level, while the current study focusses on differences in students' attitude towards chemistry objectives across gender and their relationship with chemistry achievement.

According to Ekborg and Johnels (2011), many students are unaware of the importance of chemistry, which has resulted in a significant decrease in the number of students seeking chemistry-related programs at more advanced levels. In Greece, Salta and Tzograki (2004) did not find any gender disparities in students' perceptions toward chemistry's interest, utility,

and importance. They however did not look at the students' attitude towards chemistry objectives, while performance in chemistry was not examined.

Still another study carried out in Nigeria by Adesoji (2008) developed and evaluated an eight-variable model to provide a causal explanation of secondary school students' achievement in Chemistry with regard to student variables such as attitude toward learning Chemistry, previous experience in integrated science, and so on. Teacher variables included enthusiasm toward chemistry instruction, attendance at chemistry workshops, and school environment variables such as class size, laboratory adequacy, and the location of the school. Ex-post facto research was used in this study. A total of 621chemistry teachers from senior secondary (iii) from Oyo state, Nigeria, comprised the population. When all seven predictor variables were considered combined, they accounted for 7.2% of the total effect on success in Chemistry. It also found that only four variables - including the location of the school, how the laboratory is equipped, the attendance of the teacher at chemistry-based workshop and the attitude of the teacher - had direct causal influence and provided a significant contribution to the prediction of the achievement in chemistry. He arrived at the conclusion that student achievement in Chemistry is directly related to school location, laboratory adequacy, teacher attitude toward Chemistry education, and teachers' attendance at Chemistry workshops. The above study concentrated on the attitude of teachers to chemistry teaching among other factors that predict chemistry achievement. The current study deals with students' attitudes and their influence on chemistry achievement.

Ssempala (2005) conducted a study in Uganda to see if senior students at particular mixed secondary schools in the Kampala District performed differently in terms of their practical Chemistry skills based on their gender. He observed that during the chemistry practical, there were no statistically significant differences between the abilities of girls and boys to operate the apparatus or equipment, take observations, report or record results accurately, or compute, interpret, or analyze data; Both genders reported that during practicals in chemistry, using equipment was a straightforward skill to do, but that interpreting and even analyzing the results was the most challenging;

Since the majority of girls (90%) thought boys were superior to them in the Chemistry practical, they had low self-confidence in their abilities. He asserts that although boys and girls performed similarly on average, the Uganda National Examinations Board (UNEB, 2005) examiners' evaluation of the Chemistry practical examinations was influenced more by

boys' proficiency in computing, interpreting, and analyzing results, as well as their accuracy in recording and reporting results. Therefore, he concludes that it might be the cause of boys performing better overall in 'A' level Chemistry examinations and in the UNEB Chemistry practical examination. This study only dealt with performance across gender in chemistry practical examination, the current study includes both theory examination papers 1 and 2 in addition to the practical examination paper, which are key contributors to the body of chemistry knowledge.

According to Adesokan (2002), despite the prominence accorded to chemistry and other science subjects, it is clear that students still have an unfavorable perspective about the subject, which results in poor grades as well as low enrollment. Beliefs and attitudes held by students have the power to either support or obstruct learning.

The selection and arrangement of the learning experiences are guided by objectives. To avoid the student being torn by conflicting human behavior patterns, it is crucial to choose a number of objectives that can be achieved to a large degree in the time allotted as well as to have very consistent and important ones. The secondary schools curriculum volume one (KIE 2002) contains an outline of the goals for teaching chemistry in secondary schools. The syllabus outlines that at the end of the secondary School Chemistry course the learner should be able to:

1. Select and handle appropriate apparatus for use in experimental work
2. Make accurate measurements, observations and draw logical conclusions from experiments.
3. Observe and appreciate the need for safety precautions during experimental investigations.
4. Understand and appreciate the use of chemical symbols and formulae in writing chemical equations
5. Use appropriate chemical terms in describing physical and chemical processes.
6. Identify patterns in the physical and chemical behavior of substances.
7. Apply the knowledge acquired to promote positive environmental and health practices.
8. Use the knowledge and skills acquired to solve problems in everyday life.

9. Apply principles and skills acquired in techno and industrial development.
10. Acquire adequate knowledge in chemistry for further education and for training.

A study by Inzahuli(2007) in Kenya aimed to identify differences and related elements in students' performance in physics and chemistry at the KCSE examination in Nandi North District. His aim included figuring out how pupils from different classes performed in the KCSE in both chemistry and physics, their attitude toward and sense of the value of physics and chemistry, as well as their own self-concept, attitude toward, and impression of the value of physics and chemistry among students who were categorized by gender, kind of school, location, and the association between the teachers' gender and instructional performance rating. This was done using a causal comparative design. According to his research, male pupils, those attending single-sex secondary schools, and those attending metropolitan schools performed better than their female counterparts. In chemistry, girls had a better understanding. Inzahuli (2007) study focused on students' performance in chemistry and physics, the current study specifically concentrated on the gender difference in their attitude towards chemistry objectives, as one of the elements of the chemistry curriculum and how it relates with achievement in the subject.

A comparable study was conducted by Efumbi (2002) in 15 secondary schools across five divisions of Kenya's Busia District. His primary goal was to determine the reasons behind the low academic achievement among students in Busia District secondary schools. His main concerns were the relation between learners' academic success and their KCSE grade and career ambitions; their aptitude for and level of confidence in chemistry; their parents' employment situation and educational background; parental support; adequateness of the lab equipment, chemicals, books, or involvement in experimental activities; specified educational practices, including how often assignment is given and marked, individualized practicals, additional coaching, and teaching methods, as well as gender and mathematics achievement. He discovered a correlation between pupils' Chemistry performance and their KCSE examinations grade and career expectations; adequateness of the lab equipment, chemicals, literature, and involvement in experimental activities; a few schooling procedures, such as how often homework is given and marked, individualized practicals, supplementary coaching, and one-on-one assistance; Performance in mathematics; utilization of the laboratory technique and the inverse association between students' chemistry achievement and the method's utilization in the teaching process; and finally the achievement of boys and

girls did not significantly differ. While the above study investigated several variables and their influence on chemistry academic achievement, the current study isolates one variable (students attitude towards chemistry objective) and its relationship with chemistry achievement, thus providing an in-depth analysis.

2.3 Gender difference in the relationship between students' Attitude towards chemistry content and Achievement

One of the most crucial areas of science is chemistry, which helps students grasp what goes on in their environment. It is a challenging subject most learners since chemistry themes are frequently focused on or connected to the structure of matter. Taber (2002) notes that many abstract concepts that are essential to learning more about chemistry and other sciences are frequently included in chemistry courses. There are many proven discrepancies between male and female intellectual achievement in education. Gender disparity is considered to be one of the elements that influence academic achievement by many academics and educators.

Posner (2008) notes that the forms of representation of the important ideas in the subject matter are important because they have implications both for what content is taught and how well it is taught. Therefore, the way the content is taught may have an effect on the students' performance. According to Yunus and Ali's (2013) survey, majority of students hinted that the chemistry curriculum was too broad. The students must comprehend and retain the concepts, procedures, and scientific theories from the chemistry session in addition to their ability to perform computations. They demonstrate how stressed-out students are as a result of the volume of chemistry topics they must learn. These findings are similar to those of Edomwonyi- Otu and Avaa (2011). The above findings however do not address the gender differences in the students' attitude towards chemistry content; the current study seeks to address such differences.

Olawale (2009) conducted a survey study on the variables influencing performance in chemistry in a few chosen secondary schools in Nigeria. In his study, five randomly chosen schools totaling 300 boys and girls in their senior year of secondary school participated. He found that a number of issues affected students' views toward the subject, including problems with government, insufficient textbooks, poor instructional materials, parental influence, and negative feelings on the side of teachers and students.

Osborne and Dillon (2008) conducted a study with sizable numbers of young students in Europe. The study found that boys and girls have different interests in issues connected to science. However, some research showed the contrary, revealing that males had more favorable attitudes toward chemistry than did girls. It is argued that the primary causes of these literary discrepancies were; the researchers' method of measurement, the chemistry curriculum's nature and substance, the common teaching methods employed in chemistry classes, and the learners' level of education (Cheung, 2009).

In his study to evaluate the factors influencing the implementation of chemistry curriculum in public secondary schools in Garissa Sub-County, Kenya, Muse (2017) suggests that the content of the curriculum in chemistry for secondary schools should be scaled back to a size that teachers can manage to cover within the stipulated time. In Kogi state, Nigeria, secondary education curriculum implementation was reportedly hindered by a lack of sufficient time for syllabus coverage, according to Achimugu (2016). These findings are in line with those of Montes, Ferreira and Rodriquez (2018).They contend that as students advance through the academic year groups, attitudes tend to deteriorate, presumably as a result of the introduction of increasingly abstract material that is frequently disconnected from daily activities. The study by Muse did not establish attitudinal differences towards content by gender, more so it was done in Garissa Sub- County which may have remarkable differences from Busia Sub-County, thus the necessity for the present investigation. The research in Chile by Montez, Ferreira and Rodriquez did not determine whether there were gender variations in the students' attitudes regarding the subject matter of chemistry, while in the current study gender differences in students' attitude towards chemistry content is examined.

2.4 Gender differences in the relationship between students' attitude towards chemistry methods and achievement

It has been shown that there is a correlation between attitude and instructional approaches as well as between attitude and achievement, and that achievement may be predicted from attitude ratings (Adesoji, 2008; poopola, 2008). Jegede (2007) research of students' attitudes toward chemistry revealed that they were not very motivated to learn the subject. There are discrepancies between what students want and what instructors are teaching, a phenomenon that is ascribed to unpopular teaching methods that do not foster higher order cognitive abilities.

During instructional processes, chemistry involves both practical and theoretical components that support each other (Mwangi, 2016). While the theoretical aspects of the subject can be researched using conventional methods, the study of its practical substance necessitates the utilization of experiments (Muse, 2017).

In KNEC reports, teachers are continually asked to expose students to more science experiments in order to achieve good results, according to Kapting'ei and Rutto (2014). These results are consistent with those of Okono, Sati and Awour (2015) who claim that experimenting in the classroom increases both the effectiveness of the teacher's instruction and the students' conceptual understanding. According to Mwangi (2016), there are two basic approaches to conduct experiments: in-class experiments and demonstrations. In addition to helping to develop students' scientific process skills, experiments are used to establish scientific facts, concepts, and principles (Kapting'ei & Rutto, 2014).

Yunus and Ali (2013) found that secondary school students in Malaysia had a favorable attitude toward learning chemistry when they performed chemistry experiments in the lab. This was based on their study of attitudes toward learning chemistry among secondary school students. According to a study by Nordin and Chin (2010), most students hold a positive mindset towards chemistry when they perform laboratory experiments. Because they may incorporate the concepts they have learned in class into the experiments, conducting experiments in the lab helps improve students' knowledge. Experiments can provide students with more in-depth knowledge about chemistry and also increase their enthusiasm in studying the subject (Yahaya & Ling, 2010).

A study by Narmadha and Chamundeswari (2013) investigated secondary school students' attitudes toward learning science and their academic success in the subject. Their primary objectives were to determine whether certain factors among secondary school students in central, matriculation, and state board schools were significantly correlated; to ascertain whether secondary pupils in state, matriculation, and central board schools have significantly different attitudes toward learning science and academic accomplishment; to determine if there are any notable differences in secondary pupils' attitudes toward learning science and academic achievement across state, matriculation, and central board schools. A total of 422 secondary school students from three different educational systems—state, matriculation, and central board—were chosen at random. The findings indicated that at the secondary level, there was no difference between students in matriculation board schools and students from

central board schools in terms of attitude toward learning science. Similarly, at the secondary level, students from central board schools outperformed students from state and matriculation board schools in the scientific subject. When compared to boys in all types of schools, girls were much more enthusiastic in learning science. Girls outperformed boys in science academic ability in matriculation and central board schools, however there was little gender difference in state board schools. The students' attitude about learning science and their academic success in the subject was found to be positively correlated. This study was done in Europe and therefore may not reflect the true picture in the Kenyan. Moreover, the study deals with students' attitude and academic achievement in science while the current study focuses on students' attitude towards chemistry.

According to Nadji (2013), the pupils' attitude toward the chemistry teacher is poor. Despite the fact that a higher proportion (85%) of respondents reported having positive personal relationships with their chemistry instructors, they still had negative sentiments toward the way they instruct. According to the report, the majority of teachers lack motivation and instruct in unappealing abstract ways. He observes that some instructors are inept and employ outmoded instructional strategies. The studies by Yunus and Ali (2013); Nordin and Chin (2010) and Nadji (2013) were done outside Kenya, and more so did not examine the gender influence. The current study examined gender difference in students' attitude towards chemistry methods.

2.5 Gender differences in the relationship between students' attitude towards chemistry evaluation and Achievement

The process of teaching and learning must include assessment, according to Ituma (2012). Evaluation is a process of collecting data and using reliable and valid instruments to judge the worth, value or quality of an educational entity. Evaluation can be done both formatively and summatively. Written examinations, practical assessments, and homework/assignments are the most popular evaluation methods. Ituma (2012) asserts that teachers internally create these chemistry-based school exams. In general, school-based assessment tests serve to give feedback to students and stakeholders, assess student success, get them ready for national exams, inspire them, and give a way to gauge how effective the pedagogical methods being employed are.

According to a research by Synovate under its Research Club of Kenya Project, the majority of secondary school pupils believe that some courses are taught ineffectively and that an

excessive amount of focus is placed on exams, according to Siringi (2009b). The 8-4-4 method should be revised to make it more applicable and learner-focused, according to students. This study was however carried out in only 10 schools spread across Kenya, while the current study involves all the schools in Matayos Sub-County. In addition, gender difference in students attitude towards the evaluation strategies was not examined, while the current study does.

In Makueni County, Kyalo (2016) looked into how much assessment practices affected students' performance in chemistry. He discovered that 58.3% of the teachers believed that projects and fieldwork were hardly employed in chemistry evaluation. The current study differs from the latter in that it seeks to establish gender differences in attitudes held by students towards chemistry evaluation strategies.

In the Kakamega county of Kenya, Busolo (2011) conducted a study on gender inequalities in pupils' performance in secondary school chemistry. The study aimed to find the causes of gender inequalities in student accomplishment levels in chemistry as well as ways to give boys and girls more equal opportunity to study chemistry and science in general. Twelve (12) stratified secondary schools in the Kakamega County were included in the study. A total of 386 students in all took part in the study. The study's conclusions include the following: Gender and Chemistry achievement were substantially correlated; boys had a better affinity and desire for Chemistry; and, lastly, teacher and school characteristics had minimal bearing on Chemistry achievement with regard to gender. The aforementioned study looks for causes of gender variations in chemistry achievement, while the current study focuses on gender differences in the relationship between students' attitude towards chemistry evaluation and achievement in the subject.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

The research methodology described the techniques and procedures used to identify, collect and analyze data regarding gender differences in students' attitude towards chemistry curriculum and achievement. This was presented as follows:

3.2 Research Design

Cross-sectional survey and correlation research designs, which include quantitative methods of data collecting and analysis, were chosen as the research designs for this study. By asking people about their perception, attitude, behavior, and values, survey research aims to gather data that describes current phenomena (Mugenda and Mugenda ,2003). The design was chosen for this study because it is appropriate for fact-finding in education as it produces precise data.

The relationship between students' attitude towards chemistry (objectives, content, methodology, and evaluation) and chemistry achievement was determined using a correlation approach. Without attempting to change the variables, correlation design looks into potential links between variables. By using a correlation coefficient, it also expresses the strength of the relationship between two or more variables (Fraenkel & Wallen, 2000).

3.3 Area of study

This study was conducted in all the secondary schools in Matayos Sub-County, Busia County, Kenya. Other sub-counties are Nambale, Butula, Bunyala, Samia, South Teso, and North Teso. To the West it borders the republic of Uganda, Butula and Nambale Sub-Counties to the East and Samia and Sub-Counties to the south.

The Sub-County lies on longitude $0^{0}25^{'}$N and latitude 34^{0} $15^{'}$S, (Republic of Kenya 2009). The area covers 196.2 square kilometers. The choice of Matayos as the area of study was triggered by the fact that the Sub-County has persistently registered poor mean scores in Chemistry as compared to other Sub-Counties in Busia County for the past five years as shown in Table1 (page 8).These are 3.31, 3.27, 3.09, and 3.69 from 2013 to 2016 respectively. The map showing the location of Matayos Sub-County is attached as Appendix H.

3.4 Study Population

The study populationcomprised900 Form 4 students: 356 females and 544 males from the 14 secondary schools in the sub-county, (Busia County Education Office, statistics Department, 2017). The Form 4 students were chosen for this study because they had adequately covered the syllabus for the secondary school chemistry curriculum thus the right respondents for this study.

3.5 Sample size and Sampling Techniques

Krejcie and Morgan formula was used to derive a sample size of 269 students (130 girls and 139 boys). Krejcie and Morgan (1970) have provided the following formula for calculation of a population sample,

$$S = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)},$$

Where

S = Required sample size

N =The given population

P = Population proportion assumed to be .50

d =The degree of accuracy set at .05

X^2 =Chi square value which is 3.841 for .95 confidence level.

The sample size for this study was 269 students as shown in Table 3.1.

Table 3.4: Sample frame

Gender	sample	Total population
Boys	139	544
Girls	130	356
Total	**269**	**900**

3.6 Instruments for Data Collection

The questionnaire, interview schedule, and document analysis guide were the instruments employed in the data collection process.

3.6.1 Students 'Attitude Questionnaire

The questionnaire was used to allow the researcher to reach a large sample within a short time and with no extra personnel (Creswell, 2009). The questionnaire given to the students

was meant to gather information about their gender and opinions on objectives, subject matter, methods, and evaluation of Chemistry. It was divided into four sub-scales. Sub-scale A sought information about their attitudes towards objectives. Subscale B sought information about their attitudes towards content; Sub scale C sought information about students' attitude towards Chemistry methods, while sub-scale D sought information on students' attitude towards Chemistry evaluation. The Students' Questionnaire is attached as Appendix A.

3.6.2 Interview Schedule on students' Attitude

An interview is often a face-to-face dialogue where the interviewer receives information from the subject (Cresswell, 2012). The questionnaire on information related to chemistry teaching and learning was supplemented by a student interview schedule. It was used to follow up with specific respondents following the survey, that is, to look into their responses further (McNamara, 1999). The interview schedule allowed the researcher to ask more in-depth and probing questions in order to gather more data than would have been possible with a questionnaire (Mugenda & Mugenda, 1999). The interview schedule for students is attached as Appendix B. A total of 20 students (10 boys and 10 girls) were randomly selected from the sample population. A sample size of 20 was deemed adequate for the qualitative analysis of this study because it has previously been suggested that qualitative investigations require a minimum sample size of at least 12 to obtain data saturation (Clarke & Braun, 2013; Fugard & Potts, 2014).

3.6.3 Document Analysis Guide

Document Analysis guide enabled the researcher to obtain chemistry grades for the respondents. The 2017 KCSE chemistry results were obtained for the respondents who had sat for the examination that year and the grades for each individual respondent recorded down. This was later used to analyze and determine the students' performance in chemistry. Document Analysis Guide is attached as Appendix C.

3.7 Validity of the Instruments

For face and content validity to be assured, experts from the Maseno University Department of Educational Communication, Technology, and Curriculum Studies were presented with the instruments to review and assess. According to Kothari (2004), a measuring instrument's validity refers to how well it covers the subject being studied. Content validity is good if the measures use a representative sample. Its determination is primarily judgmental and intuitive. It can also be decided by a group of people who assess how well the measurement tools

adhere to the requirements. The suggestions and recommendations from the experts were incorporated thus improved the efficacy of the instruments.

3.8 Reliability of the Instruments

To determine the reliability of the research, a pilot study was carried out on 90 students, which formed 10% of the population that was not part of the sample (Connelly, 2008).The internal consistency of the students' questionnaire was assessed using Cronbach's alpha to measure its reliability. According to Gall, Gall, and Borg (2007), it is ideal to utilize Cronbach's coefficient alpha when items are not evaluated in a binary manner; for example, when a test has questions with multiple alternative responses that are each assigned a different weight. Given that there were five rating alternatives on the scale, the alpha formula was the best approach in this situation. Students' attitude towards chemistry objective questionnaire yielded a reliability coefficient of 0.62, students' attitude towards chemistry content yielded a reliability coefficient of 0.73, students' attitude towards chemistry methods yielded a reliability coefficient of 0.87 while students' attitude towards chemistry evaluation questionnaire yielded a reliability coefficient of 0.53.Hair, Celsi, Ortinaus and Bush (2010) provides the following scale on reliability as shown in Table 3.2.

Table 3.5: Cronbach's Alpha Scale and levels of Reliability

Cronbach's Alpha	Level of Reliability
0.0-0.20	Less Reliable
>0.20-0.40	Rather Reliable
>0.40-0.60	Quite Reliable
>0.60-0.80	Reliable
>0.80-1.00	Very Reliable

The reliability values yielded by the research instruments were thus found to be good enough to determine the instruments dependability. This enabled the researcher to proceed with the study.

3.9 Data Collection Procedures

The researcher sought approval of the research proposal by Maseno University, School of Graduate Studies. The researcher then sought permission from the County Director of Education, Busia County via a letter attached as appendix I. On receiving authorization, the researcher wrote letters to the principals of schools from which data would be collected from, informing them of the intention to conduct the research in their schools. The letters from the University and the county Director of Education are attached as Appendix I and J

respectively. Thereafter, she visited the schools to seek permission to administer the questionnaire and conduct interviews to students. The questionnaires were administered in person. The questionnaires were used to measure students' attitude before sitting for chemistry KCSE exams in 2017.After the KCSE exams had been released in 2018, the researcher visited the schools again to collect the data on the chemistry performance. From the heads of institutions, pertinent documents like KCSE analyses were received, and the necessary data was then collected and recorded down.

3.10 Methods of Data Analysis

The information from the student survey, interview schedule, and document analysis guide was examined. Statistical Package for Social Sciences (SPSS) data editor was used to code and analyze quantitative data. Students' attitude was measured on a Likert scale. The researcher scored the items on the students' questionnaire on attitude towards chemistry on a 5-pointer Likert scale. When rating the positively expressed items, Strongly Agree (SA) = 5; Agree (A) = 4; Undecided (U) = 3; Disagree (D) = 2; and Strongly Disagree (SD) =1. To account for social desirability, the scoring was reversed for items that were negatively scored. Strongly Agree (SA) =1; Agree (A) =2; Undecided (U) =3; Disagree (D) =4; while Strongly Disagree (SD) = 5.The Likert scale was chosen as the scale for the questionnaire because it allowed the researcher to record and collect participant attitudes regarding particular chemistry-related issues.

Students' attitude was categorized as negative, positive or neutral. A mean score of 2.5 and below denoted a negative attitude, a mean score of between 2.5-3.5 denoted neutral attitude while a mean of 3.5 and above indicated positive attitude. Students' attitude on each of the curriculum elements was obtained by summing up the total scores of the individual student and dividing by the total number of items on each on each of the four curriculum elements on the questionnaire as shown below.

$$\bar{x} = \frac{\sum S}{n} \qquad 3.2$$

Where $\bar{x}$ = Is the mean for variable x

$\sum S$ = Sum of scores

n = Number of items on each of the sub-scales on the questionnaire

The overall students' attitude towards chemistry was obtained by summing up the mean scores of all the students and dividing by the total number of the respondents. The data on attitude was analyzed using means, frequencies and percentages.

Hypotheses testing was carried out for equality of variance of the independent variable between boys and girls. An alpha level of 0.05 was set. The null hypothesis stated that the variance of boys is equal to the variance of girls ($\sigma_b = \sigma_{g),}$while the alternative hypothesis was stated as the variance of boys is not equal to the variance of girls(($\sigma_b \neq \sigma_{g).}$Scatter plots were drawn to test for the normality of the data. Simple and multiple linear regressions were performed to test for linearity.

Pearson's Product Moment Correlation Coefficient, was used to test for correlation between the dependent variable and the independent variable. Qualitative data from open ended questions was summarized in frequency tables and verbatim quotation.

From the document analysis, the mean grade of each student was obtained from their KCSE chemistry results in the form of grades, that is, A, A-, B+, B, B-, C+, C, C-, D+, D, D-, and E. These grades were coded into their numeric equivalents, that is, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, and 1 respectively from A to E. The data was keyed into SPSS data editor for analysis. The mean KCSE performance in 2017 was obtained by summing up the individual mean score for each respondent and dividing by the total number of respondents. A mean score of 6.00-12.00 was considered high, while that below 6.00 was considered to be low. The mean score for boys was compared with that for the girls. The data was presented in form of tables and graphs.

3.11 Ethical Considerations

Prior to their involvement in the study, the respondents were asked for their consent by the researcher, who also explained the study's objectives to them. Additionally, the researcher made sure that respondents' involvement was entirely voluntary and that their confidentiality and identity were maintained in accordance with accepted research standards. In reporting data from the open-ended items in the interview schedule, the students were assigned numbers as students 1 to 269. To protect the privacy of the data, these numbers were utilized as pseudonyms. Therefore, these numbers were used to identify students.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

This chapter consists of results and statistical analyses of the data collected from samples of students. It is presented in four sections corresponding to the research objectives. These are: Gender differences in the relationship between students' Attitude towards Chemistry objectives and Academic Achievement; Gender differences in the relationship between students' Attitude towards Chemistry content and Academic Achievement; Gender differences in the relationship between students' Attitude towards Chemistry Methods and Academic Achievement; Gender differences in the relationship between students' Attitude towards Chemistry evaluation and Academic achievement;

4.2 Gender Differences in the relationship between students' attitude towards Chemistry objectives and Achievement

The study sought to establish if there was any gender difference in the relationship between students' attitude towards chemistry objectives and achievement in the subject. To achieve this, the mean attitude towards chemistry objectives was calculated for each category (boys and girls) and then correlated with their KCSE mean scores. The mean attitude categorized as positive, negative or neutral as shown in Table 4.1.

Table 4.6: Mean attitude towards chemistry objectives

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Attitude towards Chemistry Objectives	Girls	130	3.437	.492	.043
	Boys	139	3.871	.483	.041

From the table, boys held positive attitude towards chemistry objectives with a mean of 3.87, while girls' attitudes were neutral (mean= 3.44). However, both felt that attitude towards the objectives affected their academic achievement in the subject. Barnes and Marsh (2005) in their study report that male students found chemistry more interesting than female students, hence they conclude that male students have more positive attitude towards the subject than their female counterparts.

Attitude towards Chemistry objectives relates positively with students' achievement in the subject. Negative attitude implies low achievement. Out of the 269 respondents that were

involved in this study, only 155 were of the view that their chemistry knowledge will help them solve problems in everyday life. Out of these, only 47 girls representing 35.9% of the sample agreed with the statement, as shown in Appendix D. This clearly indicates the level of dissatisfaction with which the students, especially girls handle chemistry. This could in the long run affect their performance in the subject.

According to Holbrook (2005), the current curricula approaches do not give Chemistry the push it needs to become more widely known. They place more emphasis on students' conceptual growth than on their appreciation of how scientists work, which makes Chemistry unimportant to students' daily lives. Relevance, attitude, and interest in the topic are all connected. To put it another way, there is a good possibility that students will acquire favorable attitudes about the subject of science (in this example, Chemistry) if they find the content that they learn to be relevant to their daily lives and to the society in which they function. (Hofstein & Mamlok, 2011).

The ability to recognize chemical concepts, define some key concepts, recognize significant scientific questions, use their understanding of chemical concepts to explain phenomena, use their knowledge of chemistry to read a short article, or analyze information provided in commercial advertisements or online resources is known as chemical perceptive, according to Schwartz (2006).

Normality testing in the data was done for students' attitude towards objectives, and the results are presented in the form of histograms below.

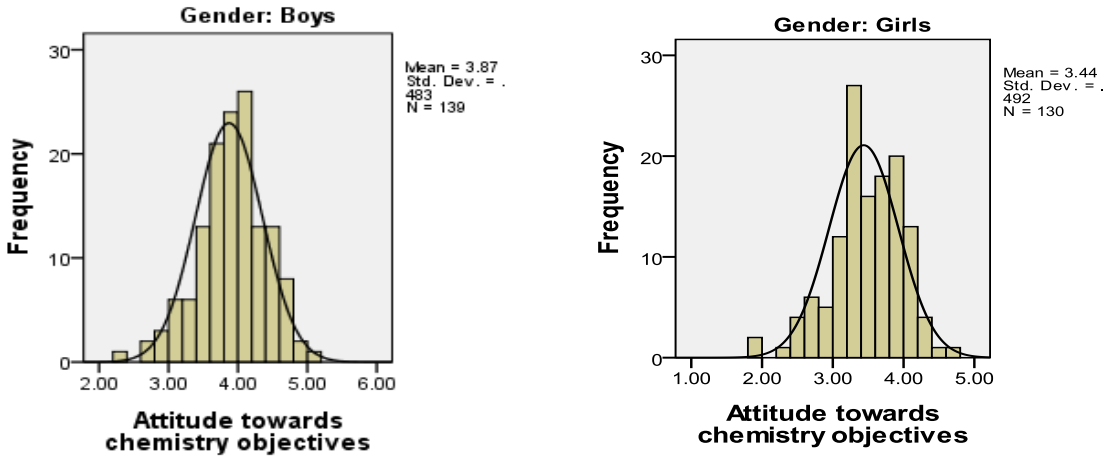

Figure 4.2: Histograms for students' attitude towards objectives

The histogram representing boys shows normal distribution of scores, while that of the girls' was slightly negatively skewed. However, the sample size (N=269) is large enough thus normality is assumed. The Central Limit Theorem states that the distribution of a sample variable approximates a normal distribution as the sample size becomes larger, regardless of the population actual distribution (Ganti, 2019).

The students' overall grade in KCSE 2017 Chemistry examination of schools in Matayos Sub-County was obtained and their means calculated. The results are shown in Table 4.2.

Table 4.7: Means and standard deviations for KCSE chemistry achievement

GENDER	Number	Mean Score	SD
Girls	130	3.12	1.76
Boys	139	4.18	2.39
Total	269	3.67	2.17

Source: Kenya National Examination Council SD= Standard Deviation

Girls obtained a mean score of 3.12, while boys had 4.18 out of the total 12 points. Boys outperformed girls in the examination.

To testfor normality in the data, histograms were drawn as indicated in Figure 4.2

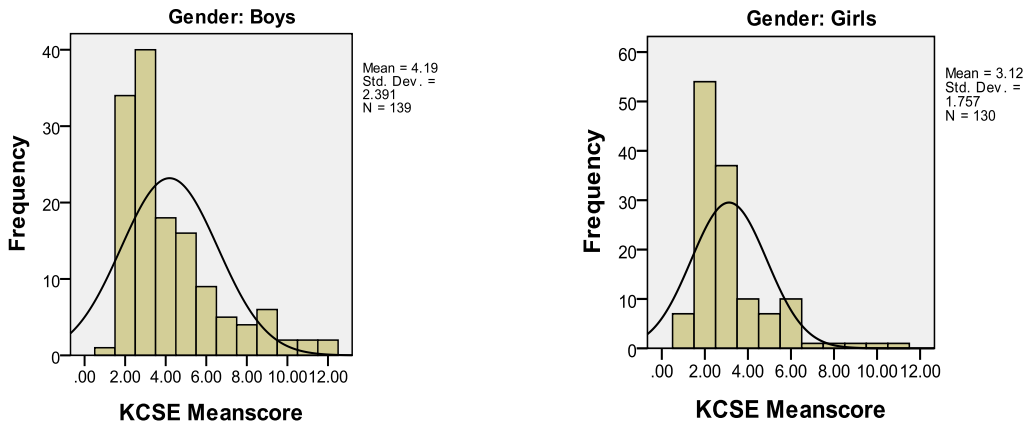

Figure 4.3: Histograms for students' attitude towards objectives

The graphs were positively skewed, with most scores appearing to the left. Normality of the data was assumed as stated by the Central Limit Theorem (CLT). The Central Limit Theorem states that the distribution of a sample variable approximates a normal distribution as the sample size becomes larger, regardless of the population actual distribution (Ganti, 2019).

Levene's test on equality of variance was carried out on the dependent variable as shown in Table 4.3.

Table 4.8: Independent sample t -Test for mean KCSE chemistry achievement

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	*t*	*df*	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
KCSE Meanscore	Equal variances assumed	*13.189*	.000	4.136	267	.000	1.063	.257	.557	1.570
	Equal variances not assumed			4.177	253.059	.000	1.063	.254	.562	1.565

P< .05

Levene's Test for equal variances showed that the homogeneity of variance was not achieved (F = 13.189, t = 4.17, p< .00). The variances however, do not differ by more than a factor of four, and the t-test is also robust against the violation of the assumption. The results of the t-test for comparison of means across gender should therefore be interpreted with caution. The results of the t-test indicated that gender differences in chemistry achievement was statistically significant, t (253) = 4.17, p< .05. The performance of boys and girls in the Kenya Certificate of Secondary Education in Chemistry in Matayos sub-county is significantly different.

To show the direction and linearity of the relationship between attitude towards chemistry objectives and achievement in chemistry, a scatter plot was drawn as shown in Figure 4.3.

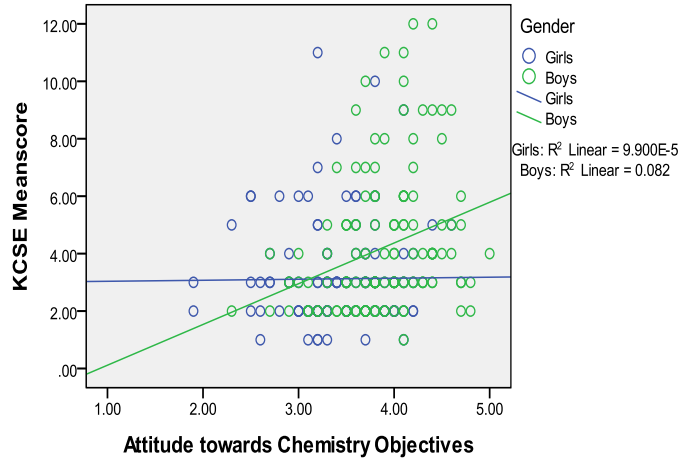

Figure 4.4: Scatter plot for students' attitude towards chemistry objectives and performance.

The scatter plot shows a non-perfect positive relationship between students' attitude towards chemistry objectives and performance in chemistry (KCSE mean score) for boys. The graph showed a disordinal interaction between boys' and girls' attitude towards chemistry objectives and KCSE chemistry achievement. KCSE chemistry mean score increases steadily with increase in boys' attitude towards chemistry objectives, while for girls, increase in attitude does not lead to any significant change in their chemistry performance.

These results concur with the findings of Amadalo (2009) who found disparities in Chemistry and Biology among different school categories as well as gender. Boys' schools realized higher mean scores compared to girls' and co-educational schools. Additionally, Busolo (2010) discovered that boys expressed a stronger acceptance of chemistry, were more interested in chemistry, found learning chemistry-related tasks easier, and show a more pronounced interest in beginning a career in chemistry. In general, boys showed more interest in and affinity for chemistry than did girls.

Inzahuli (2007) explored for differences and related factors in Nandi North district students' performance in physics and chemistry for the KCSE. He reveals that learners who attended single-sex secondary schools and those in urban schools posted better results than their female counterparts. These studies were carried out to find out the relationship between gender and Chemistry and other science subjects like Biology and Physics. The current study examines the relationship between attitude towards objectives and performance. Boys outperformed girls in the UNEB chemistry practical examinations, according to Ssempala's study from 2005, which examined senior six girls and boys in a sample of mixed secondary schools in Kampala District, Uganda.

The studies by Amadalo and Inzahuli dealt with gender differences among other factors contributing to achievement in areas of chemistry and biology, while the study by Ssempala examined gender differences and the performance in chemistry practical examination, leaving out the theory part which is equally important. The current study examines the relationship between attitude towards objectives and performance in chemistry and aims at acquainting learners with the objectives which are key in the study of chemistry.

To determine whether gender moderates the relationship between students' attitude towards chemistry objectives and achievement, multiple linear regression analysis was carried out. The regression analysis equation was stated as in the equation:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + e$$

Where Y = KCSE chemistry scores

B_o = constant

X_1 =attitude towards chemistry objectives

X_2 =Gender

X_3 = Interaction term (attitude towards objectives xgender)

e = error

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.306	2.923		2.500	.013
	Mean on chemistryobjectives	-1.347	.821	-.331	-1.641	.102
	Gender	-4.305	1.907	-.993	-2.257	.025
	Interaction	1.383	.517	1.458	2.675	.008

a. Dependent Variable: points equivalent to the KCSE meangrade
Predictors: (Constant), interaction term, Mean chemistry objectives, Gender

Table 4.9: Multiple regression analysis on Attitude, gender and achievement

The regression analysis equation was thus written as:

$$Y = 7.306 - 1.347X_1 - 4.305X_2 + 1.383X_3$$

The *p*-value for the interaction term is less than .05, hence the coefficient of the interaction term is statistically significant. This means that Gender moderates the relationship between KCSE Mean Grade and Attitude towards Chemistry Objectives.

A bivariate correlation to establish the strength of the relationship between attitude towards objectives and achievement in chemistry based on gender was carried out and the results shown in Tables 4.5 and 4.6.

Table 4.5: A bivariate correlation between attitude towards chemistry curriculum and achievement (girls)

		1	2	3	4
1	Achievement				
2	Attitude towards chemistry objectives	.01			
3	Attitude towards chemistry content	.33**	.27**		
4	Attitude towards chemistry methods	.18*	.023	.17	
5	Attitude towards chemistry evaluation	.13	.34**	.25**	.18*

***** Correlation is significant at the 0.01 level (**p<.01), *p <.05.***

Results on the relationship between boys' attitude towards chemistry curriculum and achievement in chemistry are presented in Table 4.6.

Table 4.6: A bivariate correlation between attitude towards chemistry curriculum and achievement (boys)

		1	2	3	4
1	Achievement				
2	Attitude towards chemistry objectives	.29**			
3	Attitude towards chemistry content	.37**	.53**		
4	Attitude towards chemistry method	.17**	.22**	.38**	
5	Attitude towards chemistry evaluation	.33*	.47**	.61**	.24**

*** Correlation significant at .01 (**p < .01)*
**Correlation significant at .05 (*p < .05)*

Students' attitude towards chemistry objectives showed a non-significant relationship with performance for girls (r = .01, p>.05), while a correlation coefficient of r =.29 (p < .01) was established for boys as shown in Table 4.5 and 4.6 respectively. It was construed that the relationship between achievement and attitude towards chemistry objectives was statistically significant for boys. Cohen (1988) gives the magnitudes of a correlation analysis as follows: an effect size of 0.2 is considered to be small; 0.5 is considered medium, while an effect size of 0.8 is considered large. Therefore, there existed a positive relationship between boys' attitude towards chemistry objectives and performance in the subject. On the other hand, there was no relationship between girls' attitude towards chemistry objectives and achievement in chemistry. The study therefore concludes that there exists gender differences in the relationship between students' attitude towards chemistry objectives and achievement in the subject.

4.3 Gender Differences in the Relationship between Students' Attitude towards chemistry content and Achievement

The mean attitude towards chemistry content was calculated and the results presented in Table 4.7.

Table 4.7: Mean attitude towards chemistry content

Group statistics					
	Gender	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Attitude towards Chemistry Content	Girls	130	2.974	.492	.043
	Boys	139	3.540	.574	.048

The results indicate that boys and girls had neutral attitude towards chemistry curriculum content. However, the mean score for boys was higher than that for girls (mean= 3.54) for boys and (mean=2.97) for girls out of the total 5.00 points as shown in Table 4.6. The difference in the means reveal that boys were more positive regarding the content taught in chemistry.

In an interview both sexes expressed their concerns about the level of difficulty in some chemistry topics, for example, The Mole Concept, Organic chemistry, Structure and Bonding among others. On Mole concept, students explained that the topic involved lots of mathematical calculations hence rendering the topic difficult. Students were also of the view that organic chemistry was very abstract and difficult for them to understand. Girls recorded the highest number of students (58) who strongly agreed to the statement that 'organic chemistry has always given them a headache'; forming 44.6 percent, while boys were 36 representing 25.9 percent as shown in Appendix E.

According to Sirhan, many students find chemistry to be a challenging subject because the themes are typically based on or connected to the structure of matter (Sirhan, 2007). This supports Yunus and Ali's findings, which contend that in addition to math skills, students need to comprehend and retain the concepts, procedures, and scientific theories covered in the chemistry session (Yunus & Ali, 2013).

Students detest science in addition to the topics being difficult since there is so Xmuch information to learn and so much time spent writing in scientific classes (Polland & Triggs, 2000; Ward et al., 2005). According to Jegede (2007), Edomwonyi-otu and Avaa (2011), a lot of students claimed that chemistry is too wide for them to study in a short amount of time. Due of its condensed syllabus, students sometimes find learning chemistry challenging. Many

students assert that they need to take extra lessons to cover all of the syllabus's chapters. Even students who are motivated to learn will occasionally struggle to understand the subject. But weak students find chemistry to be extremely boring and depressing (Yunus & Ali, 2013).

In a research carried out to identify school-based variables influencing the implementation of the chemistry curriculum in public secondary schools in the Garissa Sub-County of Kenya, Muse suggests that the chemistry curriculum be scaled back to a manageable size to allow it to be covered by the lessons allocated for it on the timetable (Muse, 2017). In accord, Achimugu (2016) reports that one of the factors preventing efficient implementation of the secondary education curriculum in Kogi state, Nigeria, was a lack of enough time for syllabus coverage. It is therefore up to the educators to ensure that the content of the curriculum is well organized in a manner to allow the students to properly grasp it. The study by Muse did not tackle the issue of gender influence in the chemistry curriculum, while the study by Achimugu was done in Nigeria which may not fully be applicable to the Kenyan situation.

The histograms drawn showed a normal distribution for girls, while for boys, there was a slight negative skew which did not affect the data results as stated earlier. The histograms are shown in the Figure 4.4.

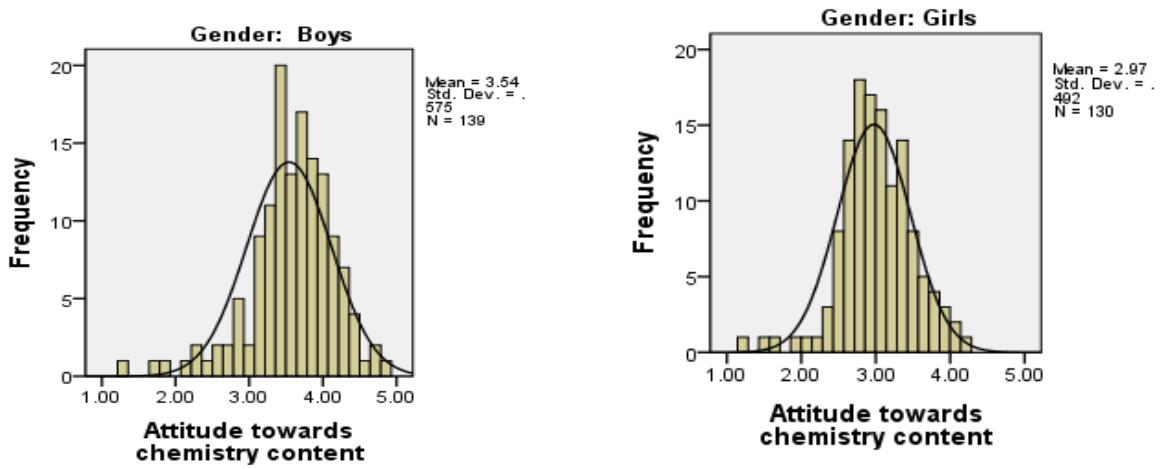

Figure 4.4: Histograms for students' attitude towards objective and achievement

A scatter plot was drawn to give a general view of the relationship between students' attitude towards chemistry content and performance in the subject a shown in the Figure 4.5.

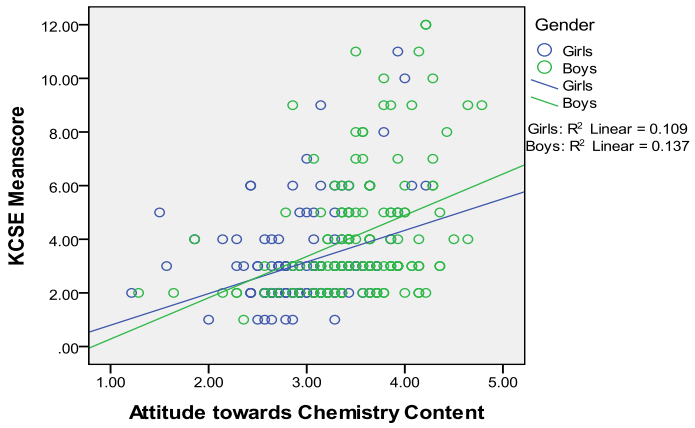

Figure 4.5: A scatter plot on students' attitude towards Chemistry Content and achievement

The plot revealed a non-perfect positive relationship between students' attitude towards chemistry content and performance in the subject for both boys and girls. There was a disordinal interaction between boys' and girls' attitude towards content and KCSE chemistry performance. At lower attitude levels, girls performed better than boys, however at higher attitude levels boys performed better than girls in chemistry, hence the views that students hold regarding the content taught in chemistry play a significant role in their performance in the subject. A multiple linear regression was run to check whether gender moderates the relationship between attitude towards content and chemistry achievement. The results are shown in Table 4.8

Table 4.8: Multiple linear regression on attitude towards chemistry content, gender, and interaction term

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.495	2.377		.208	.835
	Mean of statements on chemistry content	.818	.765	.228	1.069	.286
	Gender	-.878	1.496	-.202	-.586	.558
	Interaction term	.360	.459	.372	.785	.433

a. Dependent Variable: points equivalent to the KCSE mean grade

The results show a non-significant relationship as shown by the *p*-value of the interaction term ($p > .05$). This therefore means that gender does not moderate the relationship between students' attitude towards content and achievement in the subject.

According to Yunus and Ali (2013), majority of students hinted that the chemistry curriculum was too broad. The students must comprehend and retain the concepts, procedures, and scientific theories from the chemistry session in addition to their ability to perform computations. The study however did not interrogate gender differences, which the current study does.

A study by Montes *et al.*, (2018) on Chileans students revealed that their attitudes were neutral. They had relatively positive feelings or emotions in chemistry, but they believed that their content is tricky and challenging. However, the gender difference was not examined in this study.

4.4 Gender differences in the Relationship between Students' Attitude towards chemistry methods and Achievement

The mean scores of students' attitudes towards chemistry methods was calculated and presented as shown in Table 4.9.

Table 4.9: Students' mean attitude towards chemistry methods

Group Statistics					
	Gender	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Attitude towards Chemistry Methods	Girls	130	3.617	.480	.042
	Boys	139	3.987	.452	.038

In examining students' attitude towards methods, both sexes indicated positive attitudes towards chemistry; boys (M= 3.99, SD = .45) and girls (M=3.61, SD= .48) out of the total 5.00.

The results suggest that both boys and girls had positive attitude towards the methods employed by teachers in their teaching strategies.

Most students preferred learner centered teaching methods than teacher dominated lessons. A total of 29 students (72.5%) of those interviewed preferred student-centered methods while 11(27.5%) of the students preferred teacher centered methods. Only one student representing 2.5% agreed that they best understood when taught by lecture method. This shows that most

students do not prefer this method of instruction which is commonly used by their teachers, hence poor performance. Classroom teachers could be knowledgeable in the science content but not in pedagogical aspects. According to Ezeliore (2004), rather of adopting a hands-on approach, science is frequently taught to students using a descriptive or lecture manner. The consistent underperformance of applicants in exams provides significant evidence for the approach's potential ineffectiveness. A large percentage of students (259 representing 96.3%) preferred practical approach to teaching as shown in Appendix F.

However, in an open ended question asking which method was best suited for learning, students alluded that a combination of the above methods were suitable, but still teachers should put emphasis on the learner centered approaches. Olorundare (2010) argues that as much as learner centered approach may be striking in science teaching and the need to employ scientific methods in teaching, other approaches might be effective if used for the right reason and at the right time. Students are encouraged to become active participants in the learning process with the help of their teachers and peers in a web-based environment where they are given clearly defined and targeted assignments. According to Fielder & Brent (2003), active learning is defined as instruction that increases students' involvement in the learning process and improves attitudes and academic performance. Majority of the students said that at times the subject (chemistry) can be dry and boring. Because they may incorporate the concepts they have learned in class into the experiments, conducting experiments in the lab helps improve students' knowledge. This is consistent with Okono's assertion that teaching with an experimentation-based pedagogical method increases learners' conceptual understanding and the effectiveness of the teacher's instruction (Okono et al., 2015). The lab experiments that learners get to perform make them happy. The findings of this study concur with those of Jegede (2007) and Blosser (2009), who also found that students enjoy performing chemical experiments. The current study is different from these studies since it seeks to establish gender differences in students' attitudes towards the chemistry methods which the above studies have not.

Regarding chemistry methods, both histograms were slightly negatively skewed with outliers leaning towards the left of the graphs as shown in Figure 4.6

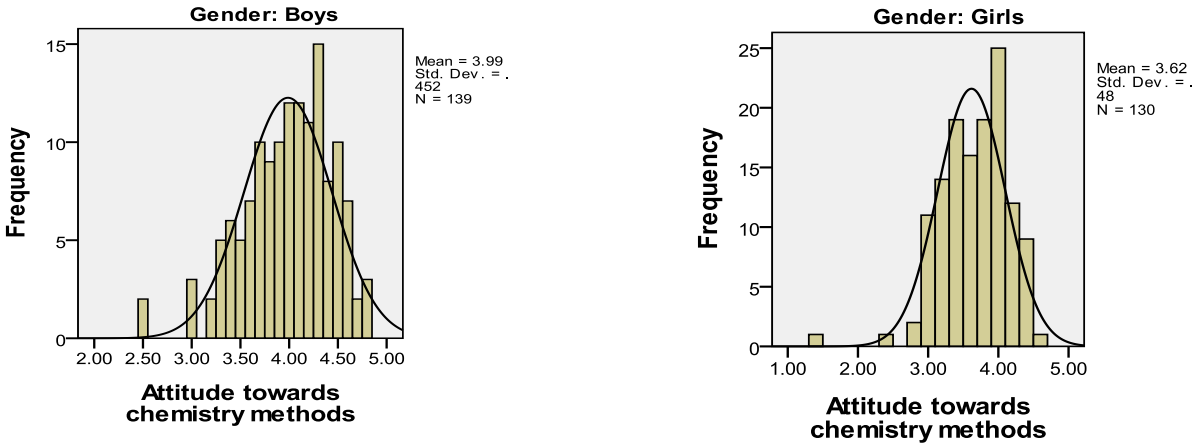

Figure 4.6:Histograms for students' attitude towards methods

However, the outliers are not as a result of any error, but occur as natural part of the observations in the sample. Iglewicz and Hoaglin (1993) allude that if the extreme value is a legitimate observation that is a natural part of the population you are studying, then you should leave it in the dataset.

A scatter plot revealed a non-perfect positive relationship between attitude towards chemistry methods and KCSE chemistry performance. There was an ordinal interaction between boys' and girls' attitude towards chemistry methods and KCSE chemistry performance, however, the graph was steeper for boys than girls with the boys displaying a higher relationship as shown in the Figure 4.7.

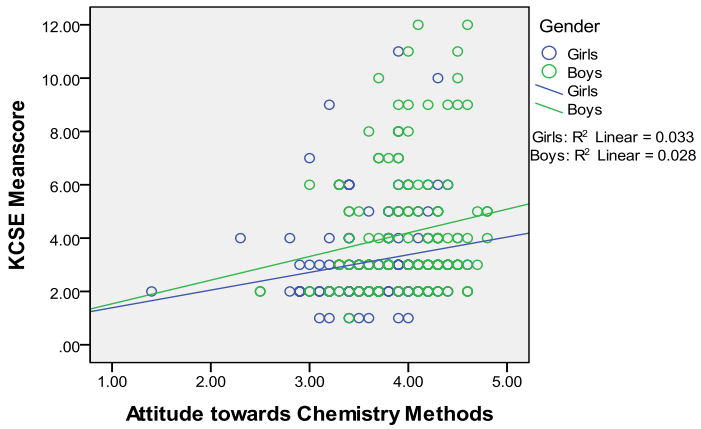

Figure 4.7: A scatter plot on students' attitude towards Chemistry methods and achievements

As students' attitude towards chemistry methods increases, achievement also increases. Boys displayed higher attitude towards chemistry methodologies than girls hence higher

performance as shown above. These findings are in line with those of Tanui et al. (2017) who found significant relationship between teacher interaction styles and gender difference in chemistry achievement and thus recommends chemistry teachers to embrace student centered teaching approaches. According to Cook, Kennedy, and McGuire (2013), the aim of chemistry teaching methods and approaches is to help students build the ability to learn the knowledge and skills they will need in the future.

Kelly (1981), who was cited by Busolo (2010), claimed that science is taught in schools in a way that is more appropriate for boys than for girls. According to some, the science curriculum contributes to the persistence of sexism in the classroom. Young females become submissive, quiet, and compassionate when sex-appropriate behaviors are reinforced, whereas boys become energetic and attentive. Girls' conceptual growth is therefore restricted to passive information reception, whereas boys' conceptual growth is promoted through a wider, inquisitive manner.

According to Busolo, when instructing girls, a more verbalized technique is probably useful. When taking into account high level cognitive skills, discovery-oriented method is helpful for both boys and girls. A combination of experiential components may boost performance for teachers who lean more toward traditional teaching methods (Busolo, 2010).The current study however deals with the relationship between attitude towards methodologies and performance in chemistry that has so far not been examined. To check whether gender moderates the relationship between attitude towards chemistry methods and achievement, multiple linear regression was run and the results as shown in Table 4.10

Table 4.10: Multiple linear regression on chemistry methods, Gender, interaction term and achievement

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	.800	3.204		.250	.803
	Mean chemistry methods	.439	.859	.101	.510	.610
	Gender	-.075	2.104	-.017	-.036	.972
	Interaction term	.224	.548	.237	.409	.683

a. Dependent Variable: points equivalent to the mean grade

The model is not fit as shown by the p > .05, hence gender does not moderate the relationship between attitude towards methods and achievement in chemistry.

4.5 Gender difference in the Relationship between Students' Attitude towards Chemistry evaluation and Achievement

Boys expressed positive attitude towards evaluation in chemistry (mean= 3.71). However, girls had a neutral attitude (mean=3.41) as shown in table 4.11

Table 4.11: Mean attitude towards Chemistry evaluation

Group Statistics					
	Gender	N	Mean	Std. Deviation	Std. Error Mean
Attitude towards Chemistry Evaluation	Girls	130	3.349	.517	.045
	Boys	139	3.689	.518	.044

Both boys and girls were positive on most statements on the questionnaire. For example, statement No.2 on the students' questionnaire "The revision exercises after every topic are important for my studies", 190 (70%) students strongly agreed with it, while 73 (27.1%) agreed. Only a smaller percentage of 0.4% disagreed while 0.7% strongly disagreed representing only one and two students respectively. They were also positive on statement No.5 and No.8 "Chemistry paper3 always boosts my performance in chemistry" and "I can always score highly in a practical paper if I work harder" as shown on Appendix G.

Feedback is crucial in inspiring continued learning. This is so that learners are aware of the extent of their learning or where they need to make improvements (Kaivanpanah, 2007).

Ituma (2012) emphasizes the importance of assessment as a part of the teaching and learning process. Written examinations, practical assessments, and homework/assignments are the most frequently utilized evaluation methods (Muse, 2017). Ituma (2012) asserts that tests given in schools are internally created by teachers. In general, they provide learners and stakeholders with feedback, assess learners' academic progress, get them ready for national exams, inspire them, and give a way to gauge how effective the educational methods being employed are. According to Ng'ong'ah (2002), the English curriculum makes no mention of evaluating the progress of specific students at each level or of what should be done with the findings of the assessments.

In Kenya, the KNEC expects students to undertake three chemistry examination papers during KCSE at the end of the four-year course. These include two papers testing on theory

and one on practicals. These three are then averaged to form the final score for the candidate. In an interview, some students alluded to the fact that they were not confident enough to face the final Chemistry examination because of lack of preparedness. They confided that the Chemistry tests they had so far done were not enough to prepare them for the KCSE examinations. (Refer to Appendix G). Based on the scores they had obtained from their previous school-based tests, they were not confident to handle the main exam. This could be the possible reason of their neutral attitude towards evaluation strategies, especially by the girls. Dee (2005) underscores that lack of practice by the learners' results in poor performance. He emphasizes that since practice makes perfect, teachers should have their students practice more in chemistry lectures.

On evaluation, both histograms were slightly negatively skewed hence tend towards a normal distribution as shown in the figure 4.8

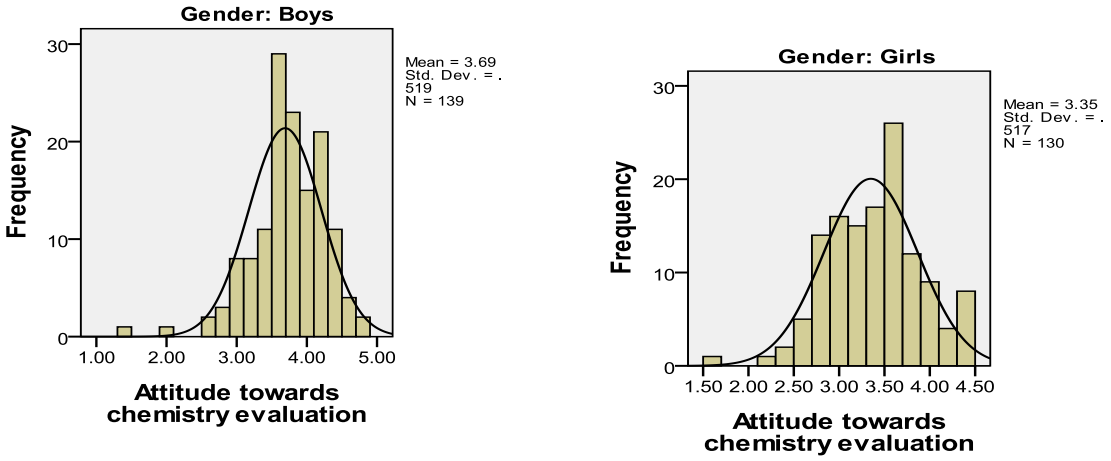

Figure 4.8:Histograms for students' attitude towards chemistry, evaluation and achievement

A correlation carried out on attitude towards chemistry evaluation revealed a significant positive correlation between achievement and students' attitude towards chemistry evaluation for boys, (r=.33**), p<.01. For girls, there was no significant correlation between attitude towards evaluation and achievement in chemistry (refer to Table 4.5 & 4.6). This shows that there is a relationship between boys' attitude towards chemistry evaluation and achievement in the subject. The attitude held by boys on evaluation strategies have a significant contribution to their achievement. The girls' attitude however do not affect their achievement in chemistry.

A scatter plot was drawn to show the relationship between attitude towards chemistry evaluation and achievement in KCSE as shown in the Figure 4.9.

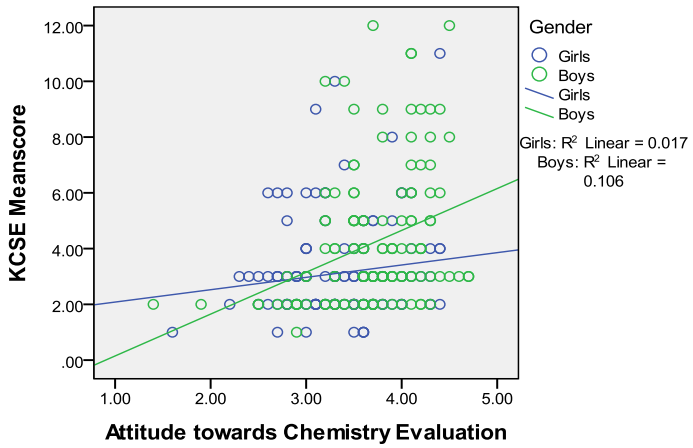

Figure 4.9: A scatter plot showing the relationship between students' attitude towards evaluation and achievement.

There was a disordinal interaction between boys' and girls' attitude towards chemistry evaluation and KCSE chemistry achievement. At lower attitude levels towards chemistry evaluation, girls performed better than boys, while at high levels of attitude boys performed better than girls. This shows that the evaluation strategies used have an effect on students' achievement in chemistry.

A multiple linear regression was run to check whether gender moderates the relationship between students' attitude towards chemistry evaluation and achievement. The results are shown in Table 4.12

Table 4.12: Multiple linear regression attitude towards chemistry evaluation, gender interaction term and achievement

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	4.629	2.655		1.744	.082
Mean chemistry evaluation	-.615	.769	-.154	-.800	.425
Gender	-2.991	1.709	-.690	-1.749	.081
Interaction term	1.058	.481	1.063	2.200	.029

a. Dependent Variable: points equivalent to the KCSE mean grade

The above model is fit since the p value for the interaction term is p < .05, hence gender moderates the relationship between students' attitude towards chemistry evaluation and chemistry achievement. The regression equation is

$$Y = 4.629 - 6.15X_1 - 2.991X_2 + 1.058X_3 + e$$

Where Y = KCSE chemistry scores

X_1 =attitude towards chemistry evaluation

X_2 =Gender

X_3 = Interaction term (attitude towards evaluation x gender)

e = error

During an interview conducted to both boys and girls separately, boys exuded more confidence in achieving quality grades in KCSE examination than girls. Girls' attitudes were perceived to be neutral. Most of them viewed chemistry as a difficult subject and as a preserve for boys. For example, when asked about which topics were difficult to comprehend, most girls said" Almost all the topics in chemistry are not easy". The above findings are similar to those of Mochire (2010) who argues that because of poor attitude held by the girls towards chemistry, their efforts are always fruitless and hence poor performance in the subject. Further, boys perform better than girls and hence are motivated to work harder. This study was carried out in Kisii Central district, Kenya. However, the current study focuses on gender differences in the attitude towards chemistry evaluation in which the earlier study did not examine.

A substantial correlation between pupils' gender and attitude toward mathematics was discovered by Ondiek (2001). He claims that there is a propensity for girls to have a negative attitude toward mathematics and that there is a possibility that girls would perform on average less well thanboys. This study was however done on mathematics; the current study sought to establish the relationship between students' gender and attitude in chemistry evaluation.

Akan and Akbas (2006) found that a student's attitude toward the chemistry course on its own is a significant predictor of chemistry achievement in their study to ascertain the level of attitude and self-efficacy towards the subject. A similar study by Sigh, Granville and Dika to compare the effects of attitude, motivation and academic engagement on academic performance revealed the importance influences of academic time, attitude and motivation on

achievement. There is the evidence of the strong effects of motivation, positive attitude and engagement in academic work for success in mathematics and science, (Sigh, Granville & Dika 2002). Many more studies done by Narmadha and Chamundeswari (2013), Ali and Awan(2013), Morgil and Secken (2004) have found significant correlation between gender and attitude towards science or one of the science subjects. The present study differs from the previous studies because it explores students' attitudes towards the various components of the chemistry curriculum in terms of objectives, methodology content and evaluation strategies. In order to promote students' achievement and enthusiasm in a particular subject, it is crucial to comprehend their attitudes. Many students today are becoming disinterested in science classes like chemistry, according to Yunus and Ali (2013). Oba, Aladejuna (2014) cites Fasakin (2012) who identified attitude as a key determinant of subject choice. He also views attitude as a mental and inherent state of readiness that is organized via experiences and directly affects how people react to all things and circumstances with which it is associated. So improving students' attitudes toward science and preparing them for life in a society that values science and technology is both in the interests of society and the duty of educators. Citizens who can comprehend and contribute to shaping the complex influences of science and technology on our planet will determine the destiny of our civilization (Ungar, 2010).

The summary of the mean attitude towards Objectives, Content, Methods and Evaluation is shown in the table 4.13.

Table 4.13: Means, Standard deviations, and Standard Error Mean for students' Attitude

	Boys				**Girls**			
Aspects	**Mean**	**SD**	**SEM**	**Attitude**	**Mean**	**SD**	**S.E.M**	**Attitude**
Objectives	3.87	.48	.04	Positive	3.43	.49	.04	Neutral
Content	3.54	.57	.05	Positive	2.97	.49	.04	Neutral
Methods	3.99	.45	.04	Positive	3.62	.48	.04	Positive
Evaluation	3.69	.52	.04	Positive	3.35	.52	.05	Neutral
Overall	**3.77**	.38	.03	**Positive**	**3.34**	.32	.03	**Neutral**

S.E.M= standard error mean, SD= Standard deviation

As shown in Table 4.13, boys displayed positive attitude in all the four curriculum aspects. The highest was attitude towards curriculum methods (mean=3.99) followed by chemistry objectives (mean=3.87), Chemistry evaluation (mean=3.69) and finally chemistry content(mean =3.54). Their overall attitude in all the aspects was positive (mean=3.77).

Girls on the other hand displayed neutral attitude in three of the four curriculum elements. These are attitudes towards chemistry objectives (mean=3.43), attitude towards chemistry evaluation (mean=3.35) and attitude towards chemistry content (mean=2.97). Attitude towards chemistry methods was the only one in which girls registered positive attitude.

These results are consistent with those of Cheung (2009) who looked at the interaction effect of year group and gender in describing attitude toward chemistry. In the early two years of their secondary school, he discovered that male students preferred chemistry theory lectures above those of their female counterparts. While the later study focuses on the year group and gender in explaining students' attitudes towards chemistry, the current study deals with gender and attitude towards chemistry and focuses on the final year students in secondary school.

However, a study by Nadji (2013) shows that students, male or female, have a low attitude toward learning chemistry. The reasons for this could be primarily related to the difficulty of the material, the low awareness of the importance of chemistry in our daily lives, a lack of exposure and field trips, unattractive and underequipped laboratories, as well as the poorly motivated teachers. This study focuses broadly on the causes of poor attitude in students towards chemistry, while the present research focuses on gender and students' attitude towards the chemistry curriculum aspects.

Other studies have also revealed similar results. Kan and Abas(2006) revealed that attitude towards chemistry is a significant predictor of chemistry achievement. Olawale (2009) established that negative attitude on the part of the teachers and students together with others were some of the factors affecting students' attitude towards the subject. According to Manoah, Indoshi, and Othuon's (2011) study, a student's attitude has a significant impact on their performance. The current study, on the other hand, focused on gender differences in the relationship between students' attitudes towards chemistry curriculum elements and achievement in chemistry whereas the earlier study examined students' attitudes toward mathematics.

Mochire (2010) argues that because of poor attitude held by the girls towards chemistry, their efforts are always fruitless and hence poor performance in the subject. Further, boys perform better than girls and hence are motivated to work harder. The study generally investigated attitude of learners. The current study isolates attitude based on separate curriculum elements which include objectives, content, methods and evaluation.

Success in chemistry had a positive impact on attitudes, according to Said et al. (2016). They reveal that the higher the cognitive and affective dimensions of attitude toward chemistry the higher the chemistry marks from prior terms. However, they found no gender effect in their study. The study was done in Qatar, thus may not really reflect on the Kenyan situation, hence the need for the current study.

Adesoji (2008) revealed that attitude towards chemistry teaching together with other variables are directly linked with achievement of students in chemistry. "In spite of the recognition given to chemistry and other science subjects, it is evident that students still show negative attitude towards the subject thereby leading to poor performance and low enrolment. Students' beliefs and attitude have the potential to either facilitate or inhibit learning" (Adekosan, 2002).

In his study, Busolo (2011) found that boys exhibited a better affinity and enthusiasm for chemistry than girls, and that gender was significantly related to achievement in chemistry. These studies investigated the influence of attitude on performance in general; the current study focuses on attitude in terms of chemistry objectives, content, methodology and evaluation, which are the elements of the chemistry curriculum.

Mochire (2010) reveals that because of the poor attitude held by girls towards the subject, their efforts are always fruitless and hence poor performance in chemistry. Therefore, the sex of the student influences the type of attitude held towards chemistry and this has a direct bearing on the final performance. She concludes that attitude is an important aspect that needs to be well developed so that it may not hinder a learner's performance negatively. The study generally looked at attitude of learners. The current study isolates attitude based on separate curriculum elements.

In a study on Czech lower secondary and secondary grammar school pupils' views toward chemistry, Kubiatko found that overall, the students' attitudes were (somewhat) favorable. With the exception of first grade, girls scored worse on attitude than boys did in every grade (Kubiatko et al. 2017).This study dealt with the lower secondary and secondary grammar school pupils, while the current study focuses on the final year students in secondary school. The current study also investigated students' attitude towards chemistry curriculum elements and their gender influence which the later did not.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1Introduction

This chapter is divided into four sections. The first section (5.2) deals with the Summary of the Findings, the second section (5.3) deals with Conclusion, section (5.4) covers Recommendations while section 5.5 covers Suggestions for further research. These have been written in line with the objectives of the study.

5.2 Summary of the Findings

5.2.1 Gender differences in the Relationship between students' attitude towards chemistry objectives and achievement

The study sought to establish if there was gender difference in students' attitude towards chemistry objectives and achievement. Boys recorded positive attitude towards chemistry objectives (mean =3.87) while girls posted neutral attitude (mean= 3 .43). The results of the regression analysis indicated that gender moderates the relationship between students' attitude towards chemistry objectives and achievement as shown by the *p* value of the interaction term ($p< .05$). Bivariate correlation between attitude towards objectives and achievement revealed a significant correlation for boys ($r=.29$, $p<.05$).There was however no significant relationship between girls' attitude and achievement in chemistry ($r=.01$, $p>.05$).

5.2.2 Gender difference in the relationship between students' attitude towards chemistry content and achievement

The mean attitude displayed by boys was higher (mean = 3.54) than girls (mean = 2.97). As such, boys' attitude towards chemistry content were deemed positive, while girls' attitude was neutral. Results from the regression analysis however indicated that gender does not moderate the relationship between attitude towards content and achievement in chemistry. The *p* value for the interaction term ($p=.433$) was not significant at $\alpha=.05$.

5.2.3 Gender difference in the relationship between students' attitude towards chemistry methods and achievement

Both sexes revealed positive attitudes towards chemistry methods (mean for boys= 3.99 while that for girls 3.62). They were positive about the methods used in their classrooms during instruction. The linear regression model indicated that gender was not a significant moderator in the relationship between attitude towards chemistry methods and achievement.

5.2.4 Gender difference in the relationship between students' attitude towards chemistry evaluation and achievement

The mean attitude towards chemistry evaluation showed that boys displayed positive attitude (mean=3.69) while girls had a neutral attitude (mean=3.35). Regression analysis on attitude towards chemistry evaluation, gender, interaction term and achievement revealed that the regression model was fit as shown by the p value for the interaction term which was .029, $p<$ .05. Gender therefore moderates the relationship between students' attitude towards chemistry evaluation and achievement. A bivariate correlation between students' attitude towards chemistry evaluation and achievement yielded r of .33 for boys. This revealed a statistically significant positive relationship between attitude towards evaluation and chemistry achievement for boys(r=.33, $p<$ .01).However, there was no statistically significant relationship established for girls(r=.13, p>.01).

5.3 Conclusion

The outcome of the present study showed gender difference in the relationship between students' attitude towards chemistry objectives and achievement. Girls had a neutral attitude towards chemistry objectives, while boys had a positive attitude. This shows that the attitude held by girls was lower than that for boys, and this could be a possible reason for boys to perform better than girls in the subject.

Gender did not moderate the relationship between students' attitude towards chemistry content and achievement in chemistry. Similarly, there was no gender difference in the relationship between students' attitude towards methods and achievement. Both boys and girls displayed positive attitude towards methods of teaching chemistry.

There exists gender difference in the relationship between students' attitude towards chemistry evaluation and achievement. The attitude held by students towards chemistry evaluation are gender related. This means that the different attitudes held by boys and girls may have profound effect on achievement hence should not be ignored.

5.4 Recommendations

The following are the recommendations of the study:

1. Teachers should inculcate the importance of the objectives of studying chemistry to learners as some learners were not aware of the role and the importance of chemistry in their carrier choice and even their daily lives.

2. Girls have neutral attitude towards chemistry objectives, hence their importance need to be emphasized.

3. Teachers should help girls demystify that some of the topics in the chemistry course are difficult. Teachers need to motivate them to change their attitudes positively.

4. Teachers need to ensure that both boys and girls get equal opportunities to participate during lesson instruction.

5. Teachers need to put proper evaluation strategies to prepare learners adequately to tackle the KCSE examination.

5.5 Suggestions for Further Research

The following are ideas for additional research:

1. A similar study to find out other factors affecting achievement in chemistry, since performance in the subject is still dismal.

2. There is need to research on other factors which may be associated with differences in Girls and Boys attitudes towards chemistry.

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APPENDICES

APPENDIX A: STUDENTS' ATTITUDE QUESTIONNAIRE

The purpose of the study for which this questionnaire is designed is to examine your attitudes towards the secondary school Chemistry in relation to your performance in the subject. All the responses and information you give will be treated with confidentiality and only used for analytical purposes of this study. Please give your views by filling in the blank spaces or putting a tick in the appropriate corresponding space.

GENERAL INFORMATION

Index No. _____

Gender: Male [ ] Female [ ]

SUB-SCALE A: STUDENTS' ATTITUDE TOWARDS CHEMISTRY OBJECTIVES

Indicate the extent to which you agree with the statements below which form the basis of the objectives in the teaching and learning of Chemistry in secondary school. Tick only once against eachstatement.**SA- Strongly Agree, A- Agree, U- Undecided, D-Disagree, SD-Strongly Disagree.**

	SA	A	U	D	SD
It is necessary to select and handle appropriate apparatus for use in experimental work.					
Understanding the use of chemical symbols and formulae in writing chemical equations is very difficult.					
I find it necessary to observe and appreciate the need for safety precautions during experimental investigations.					
I find it easy to make accurate measurements, observations and to draw logical conclusions.					
Identifying patterns in physical and chemical behavior of substances is very difficult to me.					
I usually find it difficult to use chemical terms in describing physical and chemical processes.					
My Chemistry knowledge and skills will enable me solve problems in everyday life.					
Chemistry knowledge and skills cannot be applied to promote positive environmental and health practices.					
Chemistry principles and skills are useless as far as techno and industrial development is concerned					
The Chemistry knowledge that I have acquired will be useful for my further education and training.					

SUB-SCALE B: STUDENTS' ATTITUDES TOWARDS CHEMISTRY CONTENT

Indicate the extent to which you agree with the following statements. Tick once against each statement. **KEY: SA-Strongly Agree, A- Agree, U- Uncertain, D- Disagree, SD-Strongly Disagree.**

	SA	**A**	**U**	**D**	**SD**
I understand the use of chemical symbols and formulae in writing chemical equations					
I usually find Chemistry problems very easy to solve.					
I enjoy solving questions involving structure of the atom and the periodic table					
Chemical families, patterns inproperties is a very interesting topic					
I can easily tackle any question on trends and properties of period three elements.					
There is no such interesting topic as structure and bonding					
Metals is a very wide and useless topic					
Carbon and its compound is not easy for a student to understand					
Radio activity is a very important topic for my study of Chemistry					
I usually do not like Energy changes in physical and chemical processes					
I usually find problems relating to mole concept very easy to solve					
When I think of electrolysis my mind goes blank					
Gas lawsis not a useful topic in the study of Chemistry					
Organic Chemistry has always given me a headache					

SUBSCALE C: STUDENTS' ATTITUDESTOWARDS CHEMISTRY METHODS

Indicate the extent to which you agree with each of the following statements. Tick once against each statement. **KEY: SA- Strongly Agree, A- Agree, U- Uncertain, D- Disagree, SD- Strongly Disagree.**

	SA	**A**	**U**	**D**	**SD**
I best understand when the teacher uses lecture method (teacher talk)					
I like Chemistry discussions best when the teacher is around					
It is interesting to learn Chemistry when the teacher performs an experiment himself					
I like handling apparatus for practical work					
I always get bored in my group discussion with other students.					
Performing Chemistry experiments is a waste of time					
I like revising by answering chemistry questions in my book.					
I am usually very attentive when my fellow student carries out a demonstration in a practical activity					
I usually do not get involved in practical work					
Group work always makes me lazy					

SUBSCALE D:STUDENTS'ATTITUDES TOWARDS CHEMISTRY EVALUATION

Indicate the extent to which you agree with the following statements concerning Chemistry evaluation. KEY: SA –Strongly Agree A-Agree, U - Uncertain. D – Disagree, SD- Strongly Disagree

	SA	**A**	**U**	**D**	**SD**
I don't like chemistry practical examination because it is too involving.					
The revision exercises after every topic are important for my studies.					
My good performance in Chemistry is as a result of the many examinations that I have done.					
Chemistry paper1 is always a simple paper.					
Chemistry practical paper3 always boosts my performance in Chemistry					
Chemistry paper 2 is like Greek to me					
Marking of the Chemistry examinations is not always done fairly					
I can always score highly in a practical paper if I work harder					
The three Chemistry papers are too much work for a student					
Chemistry examinations do not always capture what I have learnt.					

APPENDIX B: INTERVIEW SCHEDULE FOR THE STUDENTS

I am conducting a study on the relationship between gender, attitude and performance of Chemistry. Please answer the following questions as honestly as possible. Your answers will help establish if there is any relationship between gender, attitude and performance in Chemistry. Your responses will be confidential and will be used for research purposes only.

11. Are you studying all the three sciences i.e. Chemistry, Physics and Biology?

    a) Yes. b) No. If no why?

12. Is Chemistry your favorite subject among the sciences that you study?

13. Which method of teaching used by your teacher makes you understand best?

14. Which topics in Chemistry do you find difficult to comprehend?

15. Do you think the chemistry course is too loaded or the work is just enough?

16. Is chemistry an important subject in your career choice?

17. How many Chemistry examinations have you done this year?

18. Do you think the Chemistry examinations you have done have prepared you enough to tackle the KCSE?

19. What was your highest score in chemistry this year?

20. What was your least score in Chemistry this year

APPENDIX C: DOCUMENT ANALYSIS GUIDE

Name of school……

Students' number	**Sex (b / g)**	**Chemistry Grade in KCSE**

APPENDIX D: STUDENTS' ATTITUDE ON CHEMISTRY OBJECTIVES

statement	SA		A		U		D		SD	
	f (%)		f(%)		f(%)		f(%)		f(%	
	B	G	B	G	B	G	B	G	B	G
Handle appropriate apparatus	63	72	67	53	3	5	5	0	1	0
	(45.3)	(55.4)	(48.2)	(40.8)	(2.2)	(3.8)	(3.6)	(0)	(0.7)	(0)
Use of chemical symbols is difficult	14	30	39	49	11	16	47	28	28	7
	(10.1)	(23.1)	(28.1)	(37.7)	(7.9)	(12.3)	(33.8)	(21.5)	(20.1)	5.4)
Observe and appreciate the need of safety precautions	81	88	46	32	6	2	6	2	0	6
	(58.3)	(67.7)	(33.1)	(24.6)	(4.3)	(1.5)	(4.3)	(1.5)	(0)	(4.6)
Make accurate measurements, observations& conclusions	19	9	61	23	13	20	35	47	11	31
	(13.7)	(6.9)	(43.9)	(17.7)	(9.4)	(15.4)	(25.2)	(36.2)	(7.9)	(23.8)
Patterns in physical & chemical behavior of substances is difficult	11	32	38	48	20	21	55	22	15	7
	(7.9)	(24.6)	(27.3)	36.9	(14.4)	(16.2)	(39.6)	(16.9)	(10.8)	(5.4)
Difficult to use chemical terms.	20	35	49	56	19	15	36	21	15	3
	(14.4)	(26.9)	(35.3)	(43.1)	(13.7)	(11.5)	(25.9)	(16.2)	(10.8)	(2.3)
Solve problems in everyday life.	56	25	52	22	11	25	14	28	6	30
	(40.3)	(19.2)	(37.4)	(16.9)	(7.9)	(19.2)	(10.1)	(21.5)	(4.3)	(23.1)
Cannot promote positive environmental and health practices.	3	10	3	6	3	10	45	35	85	69
	(2.2)	(7.7)	(2.2)	(4.6)	(2.2)	(7.7)	(32.4)	(26.9)	(61.2)	(53.1)
Principles and skills are useless in techno and industrial development	3	9	2	1	2	6	45	37	87	77
	(2.2)	(6.9)	(1.4)	(0.8)	(1.4)	(4.6)	(32.4)	(28.5)	(62.6)	(59.2)
The Chemistry for further education and training.	79	82	46	31	4	10	4	3	6	4
	(56.8)	(63.1)	(33.1)	(23.8)	(2.9)	(7.7)	(2.9)	(2.3)	(4.3)	(3.1)

I understand the use of chemical symbols and formulae in writing chemical equations	41	39	78	51	8	14	9	24	3	2
	(29.5)	**(30.0)**	**(56.1)**	**(39.2)**	**(5.8)**	**(10.8)**	**(6.5)**	**(18.5)**	**(2.2)**	**(1.5)**
I usually find Chemistry problems very easy to solve.	17	10	51	19	27	22	25	51	19	28
	(12.2)	**(7.7)**	**(36.7)**	**(4.6)**	**(19.4)**	**(16.9)**	**(18.0)**	**(39.2)**	**(13.7)**	**(21.5)**
I enjoy solving questions involving structure of the atom and the periodic table	55	21	58	46	8	10	15	39	3	14
	(39.6)	**(16.2)**	**(41.7)**	**(35.4)**	**(5.8)**	**(7.7)**	**(10.8)**	**(30.0)**	**(2.2)**	**(10.8)**
Chemical families, patterns inproperties is a very interesting topic	48	35	61	52	18	25	7	7	5	11
	(34.5)	**(26.9)**	**(43.9)**	**(40.0)**	**(12.9)**	**(19.2)**	**(5.0)**	**(5.4)**	**(3.6)**	**(8.5)**
I can easily tackle any question on trends and properties of period three elements.	37	11	72	35	12	21	14	48	4	15
	(26.6)	**(8.5)**	**(51.8)**	**(26.9)**	**(8.6)**	**(16.2)**	**(10.1)**	**(36.9)**	**(2.9)**	**(11.5)**
There is no such interesting topic as structure and bonding.	23	15	40	21	31	23	27	46	18	25
	(16.5)	**(11.5)**	**(28.8)**	**(16.2)**	**(22.3)**	**(17.7)**	**(19.4)**	**(35.4)**	**(12.9)**	**(19.2)**
Metals is a very wide and useless topic	14	15	10	30	19	29	39	38	57	18
	(10.1)	**(11.5)**	**(7.2)**	**(23.1)**	**(13.7)**	**(22.3)**	**(28.1)**	**(29.2)**	**(41.0)**	**(13.8)**
Carbon and its compound is not easy for a student to understand	9	12	18	17	15	14	52	52	45	35

	(6.5)	**(9.2)**	**(12.9)**	**(13.1)**	**(10.8)**	**(10.8)**	**(37.4)**	**(40)**	**(32.4)**	**(26.9)**
Radio activity is a very important topic for my study of Chemistry.	43	27	53	31	19	23	16	23	8	26
	30.9	**20.8**	**38.1**	**23.8**	**13.7**	**17.7**	**11.5**	**17.7**	**5.8**	**20.0**
I usually do not like Energy changes in physical and chemical processes	34	30	30	50	13	7	43	28	19	15
	24.5	**23.1**	**23.1**	**38.5**	**9.4**	**5.4**	**30.9**	**21.5**	**13.7**	**11.5**
I usually find problems relating to mole concept very easy to solve	28	8	41	17	23	19	29	44	18	42
	20.1	**6.2**	**29.5**	**13.1**	**16.5**	**14.6**	**20.9**	**33.8**	**12.9**	**32.3**
When I think of electrolysis my mind goes blank	23	37	40	46	11	15	39	23	26	9
	16.5	**28.5**	**28.8**	**35.4**	**7.9**	**11.5**	**28.1**	**17.7**	**18.7**	**6.9**
Gas laws is not a useful topic in the study of Chemistry	8	13	12	3	9	20	48	45	62	49
	5.8	**10.0**	**8.6**	**2.3**	**6.5**	**15.4**	**34.5**	**34.6**	**44.6**	**37.7**
Organic Chemistry has always given me a headache.	36	58	44	41	6	5	32	15	21	11
	25.9	**44.6**	**31.7**	**31.5**	**4.3**	**3.8**	**23.0**	**11.5**	**15.1**	**8.5**

APPENDIX E: STUDENTS' ATTITUDE ON CHEMISTRY CONTENT

Statement	**SA f (%)**		**A f(%)**		**U f(%)**		**D f(%)**		**SD f(%**	
	B	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**
I best understand when the teacher uses lecture method (teacher talk)	27	16	41	24	19	7	26	43	26	40
	(19.4)	**(12.3)**	**(29.5)**	**(18.5)**	**(13.7)**	**(5.4)**	**(18.7)**	**(33.10)**	**(18.7)**	**(30.8)**
I like Chemistry discussions best when the teacher is around	47	25	55	28	10	2	17	44	10	31
	(33.8)	**(19.2)**	**(39.6)**	**(21.5)**	**(7.2)**	**(1.5)**	**(12.2)**	**(33.8)**	**(7.2)**	**(23.8)**
It is interesting to learn Chemistry when the teacher performs an experiment himself	45	20	24	16	11	4	33	45	26	45
	(32.4)	**(15.4)**	**(17.3)**	**(12.3)**	**(7.9)**	**(3.1)**	**(23.7)**	**(34.6)**	**(18.7)**	**(34.6)**
I like handling apparatus for practical work	79	53	46	55	6	6	3	10	5	6
	(56.8)	**(40.8)**	**(33.1)**	**(42.3)**	**(4.3)**	**(4.6)**	**(2.2)**	**(7.7)**	**(3.6)**	**(4.6)**
I always get bored in my group discussion with other students.	8	21	12	30	18	9	52	36	49	34
	(5.8)	**(16.2)**	**(8.6)**	**(23.1)**	**(12.9)**	**(6.9)**	**(37.4)**	**(27.7)**	**(35.3)**	**(26.2)**
Performing Chemistry experiments is a waste of time	4	5	0	3	1	3	31	19	103	100
	(2.9)	**(3.8)**	**(0)**	**(2.3)**	**(0.7)**	**(2.3)**	**(22.3)**	**(14.6)**	**(74.1)**	**(76.9)**
I like revising by answering chemistry questions in my book.	60	64	59	37	11	7	7	16	2	6
	(43.2)	**(49.2)**	**(42.4)**	**(28.5)**	**(7.9)**	**(5.4)**	**(5.0)**	**(12.3)**	**(1.4)**	**(4.6)**
I am usually very attentive when my fellow student carries out a demonstration in a practical activity	47	47	58	48	13	15	15	16	6	4
	(33.8)	**(36.2)**	**(41.7)**	**(36.9)**	**(9.4)**	**(11.5)**	**(10.8)**	**(12.3)**	**(4.3)**	**3.1**
I usually do not get involved in practical work	3	4	4	3	5	6	39	30	80	88
	2.2	**3.1**	**2.9**	**2.3**	**3.6**	**4.6**	**28.1**	**23.1**	**63.3**	**60.9**
Group work always makes me lazy	5	10	9	8	12	5	32	34	81	73
	3.6	**7.7**	**6.5**	**6.2**	**8.6**	**3.8**	**23.0**	**26.2**	**58.3**	**56.2**

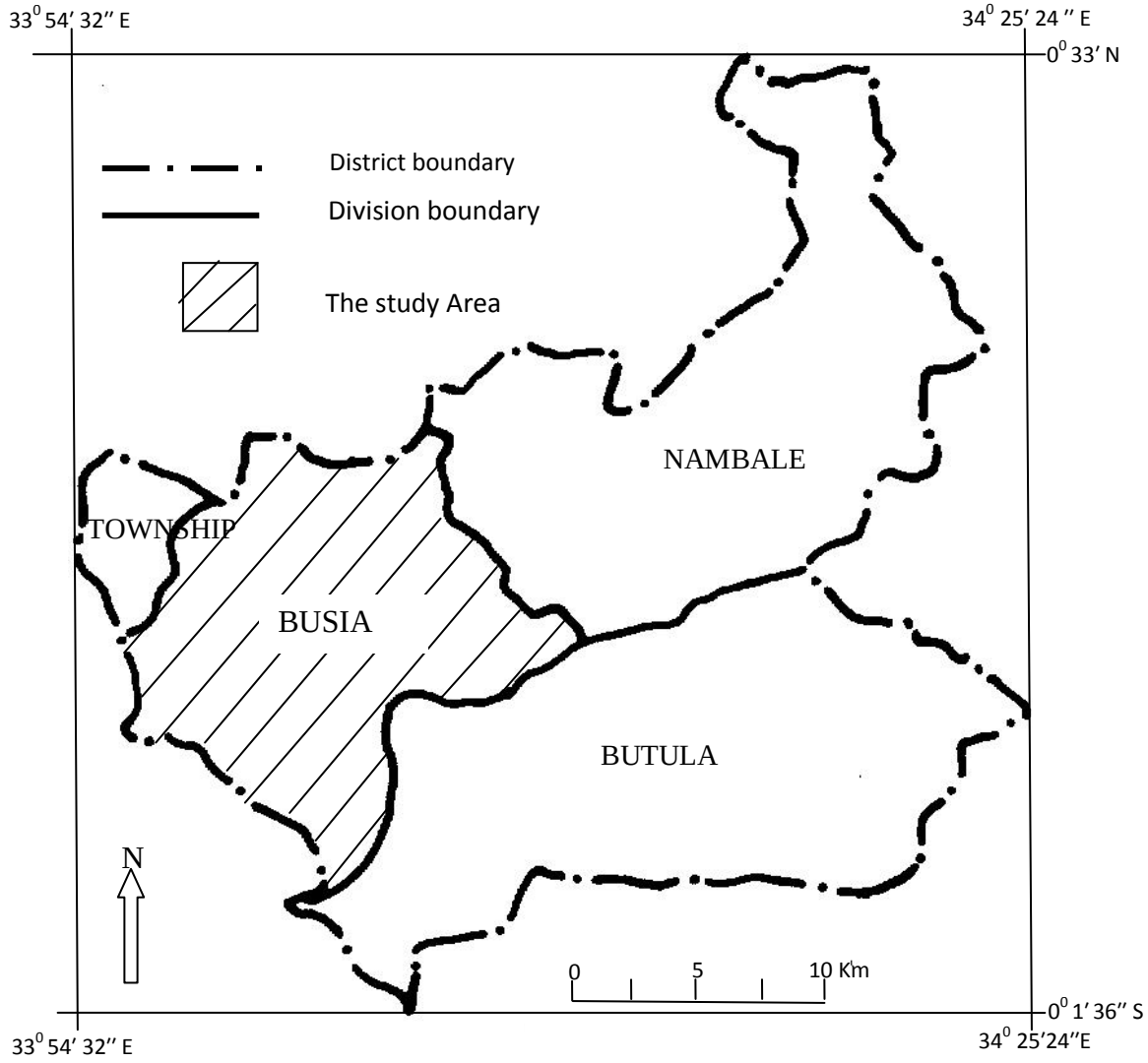
APPENDIX F: STUDENTS' ATTITUDE ON METHODS

Statement	**SA f (%)**		**A f(%)**		**U f(%)**		**D f(%)**		**SD f(%**	
	B	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**
I best understand when the teacher uses lecture method (teacher talk)	27	16	41	24	19	7	26	43	26	40
	(19.4)	**(12.3)**	**(29.5)**	**(18.5)**	**(13.7)**	**(5.4)**	**(18.7)**	**(33.10)**	**(18.7)**	**(30.8)**
I like Chemistry discussions best when the teacher is around	47	25	55	28	10	2	17	44	10	31
	(33.8)	**(19.2)**	**(39.6)**	**(21.5)**	**(7.2)**	**(1.5)**	**(12.2)**	**(33.8)**	**(7.2)**	**(23.8)**
It is interesting to learn Chemistry when the teacher performs an experiment himself	45	20	24	16	11	4	33	45	26	45
	(32.4)	**(15.4)**	**(17.3)**	**(12.3)**	**(7.9)**	**(3.1)**	**(23.7)**	**(34.6)**	**(18.7)**	**(34.6)**
I like handling apparatus for practical work	79	53	46	55	6	6	3	10	5	6
	(56.8)	**(40.8)**	**(33.1)**	**(42.3)**	**(4.3)**	**(4.6)**	**(2.2)**	**(7.7)**	**(3.6)**	**(4.6)**
I always get bored in my group discussion with other students.	8	21	12	30	18	9	52	36	49	34
	(5.8)	**(16.2)**	**(8.6)**	**(23.1)**	**(12.9)**	**(6.9)**	**(37.4)**	**(27.7)**	**(35.3)**	**(26.2)**
Performing Chemistry experiments is a waste of time	4	5	0	3	1	3	31	19	103	100
	(2.9)	**(3.8)**	**(0)**	**(2.3)**	**(0.7)**	**(2.3)**	**(22.3)**	**(14.6)**	**(74.1)**	**(76.9)**
I like revising by answering chemistry questions in my book.	60	64	59	37	11	7	7	16	2	6
	(43.2)	**(49.2)**	**(42.4)**	**(28.5)**	**(7.9)**	**(5.4)**	**(5.0)**	**(12.3)**	**(1.4)**	**(4.6)**
I am usually very attentive when my fellow student carries out a demonstration in a practical activity	47	47	58	48	13	15	15	16	6	4
	(33.8)	**(36.2)**	**(41.7)**	**(36.9)**	**(9.4)**	**(11.5)**	**(10.8)**	**(12.3)**	**(4.3)**	**3.1**
I usually do not get involved in practical work	3	4	4	3	5	6	39	30	80	88
	2.2	**3.1**	**2.9**	**2.3**	**3.6**	**4.6**	**28.1**	**23.1**	**63.3**	**60.9**
Group work always makes me lazy	5	10	9	8	12	5	32	34	81	73
	3.6	**7.7**	**6.5**	**6.2**	**8.6**	**3.8**	**23.0**	**26.2**	**58.3**	**56.2**

APPENDIX G: ATTITUDE ON CHEMISTRY EVALUATION

statement	**SA f (%)**		**A f(%)**		**U f(%)**		**D f(%)**		**SD f(%**	
	B	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**
I don't like chemistry practical examination because it is too involving.	4	25	24	31	6	9	50	28	55	37
	(2.9)	**19.2)**	**(17.3)**	**(23.8)**	**(4.3)**	**(6.9)**	**(36.0)**	**(21.5)**	**(39.6)**	**(28.5)**
The revision exercises after every topic are important for my studies.	84	99	51	25	1	4	2	0	1	2
	(60.4)	**(76.2)**	**(36.7)**	**(19.2)**	**(0.7)**	**(3.1)**	**(1.4)**	**(0)**	**(0.7)**	**(1.5)**
My good performance in Chemistry is as a result of the many examinations that I have done.	40	36	57	28	13	12	17	25	12	29
	28.8)	**27.7)**	**41.0)**	**21.5)**	**9.4)**	**9.2)**	**12.2)**	**19.2)**	**8.6)**	**22.3)**
Chemistry paper1 is always a simple paper.	17	6	47	30	29	25	29	44	17	25
	12.2	**4.6**	**33.8**	**23.1**	**20.9**	**19.2**	**20.9**	**33.8**	**12.2**	**19.2**
Chemistry practical paper3 always boosts my performance in Chemistry	65	46	53	26	7	16	12	26	2	16
	46.8	**35.4**	**38.1**	**20.0**	**5.0**	**12.3**	**8.6**	**20.0**	**1.4**	**12.3**
Chemistry paper 2 is like Greek to me	13	17	27	26	19	20	46	36	34	31
	9.4	**13.1**	**19.4**	**20.0**	**13.7**	**15.4**	**33.1**	**27.7**	**24.5**	**23.8**
Marking of the Chemistry examinations is not always done fairly	17	20	33	37	25	34	34	26	30	13
	12.2	**15.4**	**23.7**	**28.5**	**18.0**	**26.2**	**24.5**	**20.0**	**21.6**	**10.0**
I can always score highly in a practical paper if I work harder	52	60	68	56	13	6	3	6	3	2
	37.4	**46.2**	**48.9**	**43.1**	**9.4**	**4.6**	**2.2**	**4.6**	**2.2**	**1.5**
The three Chemistry papers are too much work for a student	25	40	29	42	15	19	36	22	34	7
	18.0	**30.8**	**20.9**	**32.3**	**10.8**	**14.6**	**25.9**	**16.9**	**24.5**	**5.4**
Chemistry examinations do not alwayscapture what I have learnt.	14	12	25	16	15	10	58	48	27	44
	10.1	**9.2**	**18.0**	**12.3**	**10.8**	**7.7**	**41.7**	**36.9**	**19.4**	**33.8**

APPENDIX H : MAP OF BUSIA SUB-COUNTY



APPENDIX I: PERMISSION LETTER TO CONDUCT RESEARCH

MASENO UNIVERSITY

DEPARTMENT OF EDUCATIONAL COMMUNICATION, TECHNOLOGY & CURRICULUM STUDIES

Tel: 254-057-351622/351008/351011
Ext: 3381
Fax: 254-057-351221

Private Bag
MASENO

Ref: PG/MED/070/2010

Date: September 22, 2011

TO WHOM IT MAY CONCERN

This is to confirm that **WANZALA NAFULA JOSEPHINE**, Reg. No. **PG/MED/070/2010** is a bonafide Master of Education student in this department. Her research topic is "Relationship between Attitude and Performance in Chemistry across Gender among Secondary School Students in Busia District, Kenya."

Any assistance given to her in the course of her research will be appreciated.

Thank you.

Prof. F.C.Indoshi
CHAIRMAN OF DEPARTMENT

APPENDIX J: LETTER FROM ETHICS AND REVIEW COMMISSION

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622 Ext: 3050
Fax: +254 057 351 221
Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 16th November, 2015

TO: Josephine Nafula Wanzala
PG/MED/00070/2010
Department of Educational Communication,
Technology and Curriculum Studies
School of Education, Maseno University
P. O. Box, Private Bag, Maseno, Kenya

REF: MSU/DRPI/MUERC/00231/15

RE: Gender Influence in the Relationship between Students Attitude towards Chemistry and Performance in Chemistry among Secondary School Students In Busia Sub County, Kenya. Proposal Reference Number MSU/DRPI/MUERC/00231/15

This is to inform you that the Maseno University Ethics Review Committee (MUERC) determined that the ethics issues raised at the initial review were adequately addressed in the revised proposal. Consequently, the study is granted approval for implementation effective this 16th day of November, 2015 for a period of one (1) year.

Please note that authorization to conduct this study will automatically expire on 15th November, 2016. If you plan to continue with the study beyond this date, please submit an application for continuation approval to the MUERC Secretariat by 16th October, 2016.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach the MUERC Secretariat by 16th October, 2016.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

Thank you.

Yours faithfully,

Dr. Bonuke Anyona,
Secretary,
Maseno University Ethics Review Committee.

Cc: Chairman,
Maseno University Ethics Review Committee.

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED

APPENDIX K: RESERCH AUTHOURIZATION

REPUBLIC OF KENYA
MINISTRY OF EDUCATION
State Department of Early Learning &Basic Education

Telephone: 055-22152
Fax:055-22152
When replying please quote
Email:deobusia@gmail.com

SUB COUNTY DIRECTOR OF EDUCATION
BUSIA SUB COUNTY
P.O. BOX 15 - 50400
BUSIA (K)

22nd September, 2017

Ref No. MOEST/BSA

All Principals
BUSIA SUB COUNTY

RE: RESEARCH AUTHOURIZATION

This is to authorize **WANZALA NAFULA JOSEPHINE** who is a student of Maseno University, to visit all secondary School within Busia sub County for research purposes on **"Gender influence in the relationship between students attitude towards Chemistry and performance among secondary schools students in Busia Sub County, Kenya".**

The period is between **22th September**, 2017 to **30th April, 2018.**

Please accord her the necessary support.

Thank you.

COUNTY DIRECTOR OF EDUCATION
BUSIA KENYA

OLIVER ADIKA
Sub County Director of Education
BUSIA SUB COUNTY