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Gender Differences in Attitudes towards Chemistry Curriculum Content and Performance in Chemistry

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Chemistry is one of the essential science subjects in most professional courses at the university level. Poor performance in chemistry limits the opportunity to take professional courses like medicine, veterinary medicine, pharmacy and engineering. Despite this highlighted importance of chemistry, secondary school students in Matayos Sub-County have continued to post poor results in the Kenya Certificate of Secondary Education (KCSE) examinations. From the year 2013 to 2017, the mean scores in chemistry subject ranged between 3.078 to 3.693 out of the total 12. 00 points. Analysis by gender shows that the mean score attained by boys was 2.05, while that of girls was 1.32 for the same period. This poor performance may be attributed to students' attitudes towards the subject. Students' gender could also be a pointer to the differences in the mean scores shown by boys and girls. No known study conducted in the Sub-County has established students' attitudes towards chemistry and performance across gender. The purpose of this study was to establish gender differences in the relationship between students' attitude and performance in chemistry in secondary schools in Matayos Sub-County, Kenya. Correlation research design was employed. The target population was 900 form four students from all the 14 secondary schools in the sub-county. A sample size of 269 students was obtained. A stratified sampling technique was used to select 130 girls and 139 boys. Research instruments used to collect data were students' questionnaires, interview schedule and document analysis guide. Reliability of the students' questionnaire. Validity, the instruments were presented to experts from the Department of Educational Communication, reliability 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) were used for analysis of quantitative data reported in an ongoing process as themes and sub-themes emerged. The study found that there were gender differences in the relationship between students' attitude towards content (r = .37 for boys, r = .33 for girls).

Keywords: Gender, differences, attitudes, chemistry content, performance

Introduction

Chemistry is one of the foundations of science, technology and industry. It forms the fundamentals of the life sciences. According to Ituma (2012), Knowledge of chemistry is required in the provision of services and production of quality goods. Mwangi (2016); Njagi and Silas (2015) reported that the subject 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, chemistry is first presented to learners at the secondary school level of the basic education curriculum. Some aspects of chemistry are taught at the primary school level, however, during this stage, those concepts are presented integrated in science subjects (Ituma, 2012). While the primary school curriculum focuses on materials such as natural phenomena or the human body, the secondary school content is more abstract and includes thinking skills (George, 2006; Said, Summers, Abd-El-Khalick, & Wang, 2016). Despite the highlighted importance of chemistry knowledge in the academic area, the subject's performance in Kenya

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Certificate of Secondary Education (KCSE) over the years has perpetually remained lower in comparison to its fellow science subjects namely, Biology and Physics (Kenya National Examinations Council, 2007; Muse, 2017). The poor performance in chemistry in National examinations may be an indicator that the stated objectives in the teaching of the subject are not being achieved. This is a concern for the government, parents, educators and all stakeholders. If performance in the National examinations is very poor, then it can be assumed that little learning is taking place. Table 1 shows KCSE mean scores for chemistry in comparison with sub-counties in Busia County.

Table 1
KCSE Chemistry Mean Scores for Busia County from the year 2013 to 2017

	2013	**2014**	**2015**	**2016**	**2017**
Bunyala	4.56	4.824	3.30	3.478	4.334
Nambale	3.810	4.621	5.208	4.963	3.361
Butula	3.258	3.008	4.001	5.427	4.97
Teso North	4.631	3.301	4.108	3.905	5.127
Teso South	4.017	3.89	4.41	4.811	4.086
Matayos	3.312	3.272	3.094	3.693	3.078
Samia	4.665	4.891	3.010	4.283	3.550

From Table 1, Matayos Sub-County has the lowest trend in the mean score compared to the other six sub-counties i.e. 3.312, 3.272, 3.094, 3.693 and 3.07 from 2013 to 2017 respectively.

The subject has also shown a backward trend in comparison with its three other science subjects, that is biology and physics in Matayos Sub-County from the year 2013 to 2017.

Table 2
K.C.S.E Mean scores for Biology, Chemistry and Physics for Matayos Sub-County

Year	**2013**	**2014**	**2015**	**2016**	**2017**
Biology	5.264	5.552	4.684	4.163	5.697
Chemistry	3.312	3.272	3.094	3.693	3.078
Physics	4.750	4.281	4.432	4.825	4.723

Source: Matayos Sub-County Education Office

From the Table 2, biology recorded the highest mean scores ranging from 4.163 (2016) to 5.697 (2017). This was followed by physics which recorded a mean ranging from 4.281 (2014) to 4.825 (2017). Chemistry recorded the least performance with mean scores ranging from 3.078 (2017) to 3.693 (2016). Chemistry like other subjects is graded nationally on a 12-point scale. A score of 3.693 in chemistry is way below average.

Analysis of performance by gender shows that girls recorded a lower performance as compared to their male counterparts. The results of the KCSE mean scores out of the total 12 points by gender from the year 2013 to 2017 are shown in Table 3.

Table 3
KCSE Chemistry Mean Scores by Gender from Year 2013 to 2017

Year	**Gender**		**Total**
	Boy	**Girl**	
2013	2.112	1.20	3.312
2014	2.092	1.18	3.272
2015	1.864	1.23	3.094
2016	1.56	1.113	3.693
2017	1.618	1.46	3.078

Source: Matayos Sub-County Education Office

Referring to Table 3, girls have recorded a lower performance across the years as compared to their male counterparts. This consistent low performance is what prompted this research in Matayos Sub-County.

Gender Inequality in Basic Secondary Education . The current global trend and research emphasis is on gender issues following the millennium declaration of September 2000 (UN General Assembly, 2000) which has as its goal, the promotion of gender equity, the empowerment of women and the elimination of gender inequality in basic secondary education. Unfortunately, gender inequality in education has remained a perennial problem of global scope (Bordo, 2001; Reid & Skryabina, 2003; United Nations Educational, Scientific and Cultural Organization, 2003).

The sources of gender differences in educational outcomes have been the subject of considerable study and debate. A contentious issue involves the possible role played by biological differences between males and females. Cahill (2005); Halpern (2000); Lippa (2005) noted that there are differences between male and female brain structures and in exposure to sex hormones that appear to influence the gender-specific skill advantages.

Cheung (2009) in his analysis reported that various studies regarding gender have revealed inconsistent results. He noted that the first research conducted on gender was in Israel by Hofstein (1977). The study revealed that girls had more positive attitudes towards studying chemistry than boys. Still in another investigation, Cheung (2009) reported a meta-analytic investigation conducted by Steinkamp and Maehr (1984) which showed that girls had more positive attitudes compared to boys.

Favourable attitudes that arise at an early age do not remain constant throughout a student's time at school. In fact, they tend to decrease, and in the case of chemistry in particular, there is a gradual loss of interest in the subject, accompanied by feelings of boredom and rejection, and experiences of failure. Cheung (2009) investigated the interaction effect between year group and gender in explaining attitudes

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towards chemistry and found out that male students enjoyed chemistry theory lessons more than their female counterparts during the first two years of secondary school. However as they progressed into the final two years, their liking for chemistry laboratory work declined, matching that of their female counterparts. In contrast, female students' enjoyment of chemistry grew steadily across the year groups, before sinking in the final year. These findings point out the need to develop positive attitudes and sustain them as such. Hofstein and Mamlok-Naaman (2011) argued that developing a positive attitude towards and interest in science in general and learning science in particular, is one of the key goals for teaching and learning sciences. It is therefore in the interest of society and the responsibility of educators to improve students' attitudes towards science and to prepare them to live in a highly scientific and technological society.

Several researches on attitudes towards science 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 several factors. Some researchers point out teachers and other learners, while others point to the chemistry syllabus itself as some of the factors that could be influencing attitude. In their study, Anwar and Bhutta (2014) revealed that the socio-cultural context in which the students are immersed, for instance, the neighbourhood in which they live including friend and family relations can influence beliefs and feelings towards the chemical sciences.

The findings of Yunus and Ali (2013)in Malaysia revealed that most students have a negative attitude towards chemistry because 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); Said et al. (2016) observed that attitude towards science tends to become less favourable with age, which seems to be related to the content of the science curriculum. While the primary school curriculum focuses on materials such as natural phenomena or the human body, the secondary school content is more abstract and includes concepts that are not observable to the naked eye, and therefore require the use of higher thinking skills. These findings are similar to those of Can (2012) who pointed out that attitudes tend to become less favourable as students advance through the year groups, possibly as a result of the introduction of more abstract content which is far removed from day-to-day activities. A study by Jegede (2007) related to probing students' attitude towards chemistry indicated a low level of student motivation to engage in chemistry learning, a fact which he attributes to the difficulty of chemistry among other factors, hence attitude seems to be modulated by a number of factors that constitute a more complex construct than expected, and this reveals the need to address them across different educational levels and cultural contexts (Ferreira Campos, Rodríguez, & Montes, 2018).

A study by Narmadha and Chamundeswari (2013) to investigate attitude towards learning science and academic achievement in science among secondary school students revealed that there is a relationship between attitude towards learning of science and academic achievement in science. Can (2012) reported gender differences between years 10 and 11 on the dimensions of enjoyment and importance of chemistry as a school subject. In Australia, Barnes et al., (2005) explored sex differences in enrolment intentions expressed by students in Sydney. He concluded that males found chemistry more interesting than females.

In Uganda, Ssempala (2009) reported that although girls performed slightly better than boys in his study to determine if there were gender differences in the performance of chemistry practical skills, he notes however that boys performed slightly better than girls in recording/ reporting results correctly, and computing/ interpreting/analysing results, which contributes to a higher percentage in the assessment of chemistry practical examinations by the Uganda National Examinations Board (UNEB) examinations. He concludes that this could be the reason why boys perform better than girls in the UNEB practical exams. The above findings are consistent with Cheung (2009); Kubiatko, Balatova, Fancovicova, and Prokop (2017). These studies however were carried out in other parts of the world, hence the need for the current study in Kenya.

Problem Statement

Chemistry is one of the essential science subjects in most professional courses at the university level. Poor performance in chemistry limits the opportunity to take professional courses like medicine, veterinary medicine, pharmacy and engineering. Although the then Minister for Education in Kenya announced an improvement in the subject performance in the year 2017 schools in Matayos Sub-County are still underperforming in the subject. The Sub-County has recorded mean Scores of 3.312, 3.272, 3.094, 3.693 and 3.073 out of the 12.00 points from the year 2013 to 2017 respectively in the Kenya Certificate of Secondary Education, as shown in Table 1 above. If this trend goes on, Matayos Sub-County will have no contribution to the county and the nation at large in terms of professionals like doctors, engineers and many others who require a mandatory pass in chemistry. Therefore this study is timely in an attempt to address this misnomer.

Studies worldwide have shown that attitude plays a profound role in students' achievement. The majority of studies demonstrate that boys record more positive attitude towards science than girls. Others have shown a significant relationship in the influence of gender on attitude and performance in various science subjects, while others have shown no relationship. These studies have focused on science as a wider

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subject in other parts of the country and the world at large. In Matayos Sub-County, analyses of the past KCSE results by gender have shown that girls have posted a lower mean score compared to boys. There are no documented studies on the reason behind this dismal performance in Matayos Sub-County. It was against this background that the researcher was prompted to establish if there existed any gender differences in students' attitude towards the objectives of chemistry, the content, the teaching and learning methodologies and the evaluation strategies employed in the teaching and learning of chemistry and if this attitude affects their performance in chemistry among secondary schools in Matayos Sub-County, Busia County, Kenya.

Research Questions

The study was guided by the following research questions.

1. What gender differences in attitudes towards chemistry content exist among secondary school students in Matayos Sub-County?

2. Is there a relationship between student attitudes towards chemistry curriculum content and performance in chemistry?

3. What strategies should be used to increase the levels of attitudes of boys and girls towards chemistry?

Research Hypotheses

The following were the hypothesis of this study.

1. There is a relationship between student gender and altitudes towards chemistry curriculum content.

2. There is a relationship between student attitudes towards chemistry curriculum content and performance in chemistry.

Scope of the Study

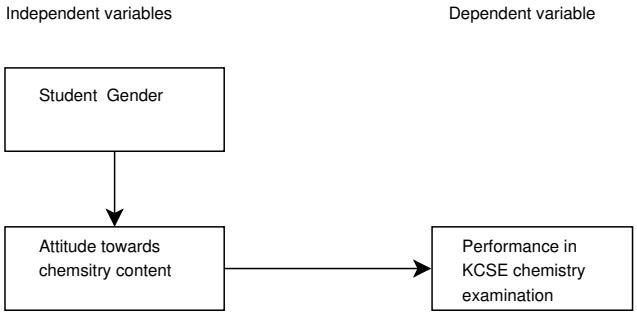
This study focused on the relationship between attitude and performance in chemistry across gender among secondary school students in Matayos Sub-County, Busia County. It covered both mixed day and boarding schools, and also separate girls' and boys' boarding schools in the sub-county. The study was limited to only form four students because they had adequately covered the secondary chemistry curriculum. The findings focus on the KCSE examinations only.

Conceptual Framework

This study examines the relationship between three construct variables: gender; attitude, and Performance in chemistry. It is hypothesised that the students' gender influences their attitude towards chemistry which in turn determines their performance in the subject.

Gender is the range of characteristics pertaining to and differentiating between masculinity and femininity. It includes the state of being male or female. Attitude refers to students' inclinations towards the chemistry curriculum. The attitude could be positive, negative or neutral.

Figure 1. Conceptual Framework



When students have a positive attitude towards the chemistry curriculum, it is expected that this will positively influence their performance. On the other hand, when students have negative attitudes towards the chemistry curriculum, this will impact negatively on their performance.

Student's attitude towards the learning of chemistry is a factor that has long attracted attention of researchers. Adekosan (2002) asserted that despite the realisation of the recognition given to chemistry among science subjects, it is evident that students still show negative attitude towards the subject, thereby leading to poor performance and low enrolment.

The chemistry curriculum is broadly divided into four elements: Objectives; Content; Methodology; and Evaluation. Objectives are specifications of intent for learning. Objectives form the basis for the selection and organization of the learning experiences. For good performance in chemistry to be realized then the set objectives should be realized at the end of the four year course.

Content of the curriculum denotes a body of knowledge. Posner (2008) noted 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 student performance. Kituku (2004) stated that topics and sub-topics should be arranged in a logical order to allow for a logical flow of content.

Methods constitute teaching and learning experiences; and involve organizational strategies. Flexible teaching methods facilitate learning. Successful teaching and learning of chemistry depend partly on the correct use of a teaching method whose activities target most learning senses. Effective teachers generate the greatest opportunity for students to learn and technically manage instruction, but teaching methods that allow students to use hands, eyes, ears and the mind also enhance effective learning and students' achievement (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

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KCSE examinations.

The last element of curriculum is evaluation. 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 provides information that can be used by teachers, students, parents and other education stakeholders.

Operational Definition of Concepts and Variables

Attitude Refers to students scores on attitude scale towards chemistry categorized as positive, negative or neutral.

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.

Performance Refers to the quantitative measure of students chemistry scores at Kenya Certificate of Secondary Education.

Chemistry curriculum Refers to objective, content, methodology and evaluation strategies used in teaching and learning chemistry.

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

Methods Refers to the teaching and learning strategies used in chemistry classroom.

Evaluation Refers to formative and summative assessments.

Research Design and Methodology

Research Design

The research design adopted for this study is correlational research design. Correlational design was used to establish the relationship that existed between students' gender, attitude and performance in chemistry. Correlation design attempts to investigate possible relationships among variables without trying to influence those variables. It also describes the degree to which two or more variables are related by the use of a correlation coefficient.

Study Population

The study population comprised 900 Form IV students; 356 females and 544 males from the 14 secondary schools in the sub-county, (Busia County Education Office, statistics Department, 2017). It was assumed that by the time of study, the participants will have completed their secondary school chemistry curriculum thus the right respondents for this study.

Table 4
Sample Frame

Gender	Sample	Total Population
Boys	139	544
Girls	130	356
Total	269	900

Area of Study

This study was conducted in public secondary schools located in Matayos Sub-County, which is situated within Busia County, Kenya. Matayos is one of the sub-counties in Busia County, alongside Nambale, Butula, Bunyala, Samia, South Teso, and North Teso. To the west, it shares a border with the Republic of Uganda, while Butula and Nambale Sub-Counties are to the east, and Samia Sub-County is to the south

The Sub-County lies on longitude 34.1685° E and latitude 0.3618° N. The Kenya 2019 census estimates the sub-county to have a total population of 111,345 as projected from the 2009 national population census. The area covers 196.2 square kilometres. The choice of Busia 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 Table 1.1, These are 3.31, 3.27, 3.09, 3.69 and 3.07 from 2013 to 2017 respectively.

Instruments for Data Collection

The instruments used in data collection included the questionnaire, interview schedule and document analysis guide.

a. 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, 2012). The students' questionnaire was used to collect data concerning their gender, attitudes towards chemistry in relation to its objectives, content, methodology and evaluation. It contained four sub-scales. Sub-scale A sought information about their attitudes towards objectives. Sub-scale B sought information about their attitudes towards content; Subscale 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.

b. Interview Schedule on Students' Attitude. An interview is typically a face-to-face conversation between a research and a participant involving the transfer of information to the interviewer (Creswell, 2012).

Interview Schedule for students was used to complement the questionnaire on information regarding to teaching and learning of chemistry. It was used to follow up with individual respondents after the questionnaire i.e., to further

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investigate their responses Brown, McNamara, Hanley, and Jones (1999). The interview schedule enabled the researcher to get more information by use of probing questions so as to get in-depth information which would not be possible to get using a questionnaire. The interview schedule for students is attached as Appendix B. A total of 20 students; 10 boys and 10 girls were selected from the sample population by stratified sampling to form the representative sample. It has previously been recommended that qualitative studies require a minimum sample size of at least 12 to reach data saturation (Clarke & Braun, 2013; Fugard & Potts, 2015) Therefore a sample of 20 was deemed sufficient for the qualitative analysis of this study.

c. Document Analysis Guide. Document Analysis guide enabled the researcher to obtain chemistry grades for the respondents. The 2017 KCSE results were obtained and the grades for each individual respondent were recorded. This was later used to analyse and determine the students' performance in chemistry. Document Analysis Guide is attached as Appendix C.

Validity of Instrument Results

For content validity to be assured, the instruments were presented to experts from the Educational Communication, Technology and Curriculum Studies Department of Maseno University for scrutiny and examination. Kothari (2004) defined content validity as the extent to which a measuring instrument provides adequate coverage of the topic under study. If the measurements contain a representative sample, then content validity is good. Its determination is primarily judgemental and intuitive. A panel of persons who judge how well the measuring instruments meet the standards can also determine it. The suggestions made by the experts were used to revise the instruments before collecting data.

Reliability of Instruments

Reliability of the students' questionnaire was determined by the use of Cronbach's alpha formula for the internal consistency of the instrument. Gall, Gall and Borg (2007) assert that Cronbach's coefficient alpha is best used when items are not scored dichotomously; for instance, when a test includes items that have several possible answers, each item is given a different weight. In this case, the alpha formula was an appropriate method because it involved a rating scale with five options. Students' attitude towards the chemistry objective questionnaire yielded a reliability coefficient of 0.62, Students' attitude towards chemistry content yielded a reliability coefficient of 0.73, Student 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. These values were considered high enough to judge the instruments as reliable. Hair (2010) provided the following scale on reliability. The reliability of other instruments results was estimated using test-retest technique.

Cronbach's Alpha Scale	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

Data Collection Procedures

The researcher sought permission from the Ministry of Higher Education, Science and Technology particularly the National Council for Science and Technology through the School of Graduate Studies, Maseno University. The Busia County Education Officer was then informed of the intention to conduct research in secondary schools in the county for the period the research project was in progress. On obtaining the permission, the researcher sent letters to heads of the schools where the data was to be collected.Thereafter, she visited the schools to seek permission to administer the questionnaire and conduct interviews to students. The questionnaires were administered in person. They were used to measure students' attitude before sitting for chemistry KCSE exams. After the KCSE exams had been released, the researcher visited the schools again to collect data on chemistry performance. Relevant documents such as KCSE analysis were obtained from the heads of institutions and the required information was recorded.

Data Analysis Procedures

Data were analysed using frequencies percentages, mean scores and standard deviations. The first hypothesis was tested using t-test for independent samples.

An independent sample t-test was used to compare the students' mean scores on attitude and performance in chemistry. Pearson's Product Moment Correlation Coefficient, r was used to test for correlation between attitude and performance in chemistry. Qualitative data from open ended questions was summarised 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 i.e. A, A-, B+, B, B-, C+, C, C-, D+, D, D-, and E. These grades were coded into their numeric equivalents, i.e. 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 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.

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Data were coded and analysed using Statistical Package For Social Science (SPSS) data editor.

Ethical Considerations

The researcher sought consent from respondents prior to their participation in the study, and explained to the respondents the purpose of the study. The researcher also ensured that the participation of the respondents was purely voluntary and that their confidentiality and anonymity was kept in line with acceptable research ethics. In reporting data from the open-ended items in the interview schedule, the students were assigned numbers as students 1 to 269. These numbers were used as pseudonyms for confidentiality of the information. Students were therefore referred to by the use of these numbers.

Presentation and Discussion of Findings

Introduction. This chapter consists of results and statistical analyses of the data collected from samples of students. Data was collected using questionnaire and interview schedule. The variables in this study included students' gender, attitude towards objectives, Content, Methods, and Evaluation and their performance in chemistry. The following were the findings of the study.

Gender Difference in Students' Attitude towards Chemistry Curriculum Content. 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. This is shown in Table 5.

Table 5
Mean, Standard Deviation, and Standard Error Mean for Students' Attitude towards Content.

	Mean	Standard Deviation	Standard Error Mean	Attitude
Boys	3.54	0.57	0.05	Positive
Girls	2.97	0.49	0.04	Neutral

The difference in the means reveals 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 a lot 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 with the statement that organic chemistry has always given them a headache forming 44.6 per cent, while boys were 36 representing 25.9 per cent.

Chemistry topics are generally related to or based on the structure of matter, and prove to be a difficult subject for many students (Sirhan, 2007). This is in agreement with the findings of Yunus and Ali (2013) who argued that on top of knowing how to do calculations, the students must also understand and remember the concepts, processes and scientific theories in the chemistry lesson.

Apart from the difficulty of the concepts, students also dislike science because of the amount of information they have to learn as well as the amount of time spent writing in science classes (Pollard & Triggs, 2001). According to Jegede (2007), many students said that chemistry is too broad for them to learn in a short time. Students find it a bit difficult to learn chemistry because of its cramped syllabus. A lot of students claim that they have to make extra classes to cover all the chapters in the syllabus. Students who truly want to learn will have a little problem grasping the concept. However, weak students find chemistry exceedingly dull and dreary (Yunus & Ali, 2013).

In agreement, Achimugu (2016) reported that lack of adequate time for syllabus coverage was among the factors negating effective implementation of secondary education curriculum in Kogi state, Nigeria. 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 (2016) was done in Nigeria which may not fully apply to the Kenyan situation.

Students who truly want to learn will have a little problem grasping the concept. However, weak students find chemistry exceedingly dull and dreary (Yunus & Ali, 2013) In a recent study to find out school-based factors influencing implementation of chemistry curriculum in public secondary schools in in Garissa County, Kenya, Muse (2017) recommended that the chemistry curriculum should be reduced to manageable size to enable its coverage by use of chemistry lessons allocated on the teaching timetable .

On attitude towards chemistry content, the histogram 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 figures below.

Independent sample t test was run to determine if there existed any statistical difference in mean scores between boys' and girls' attitude towards content.

Levene's test shows equal variances between boys' and girls' attitude towards chemistry content ($F = 1.510, p = .220$). Gender differences in students' attitude towards chemistry content was statistically significant ($t = 8.637, df =$

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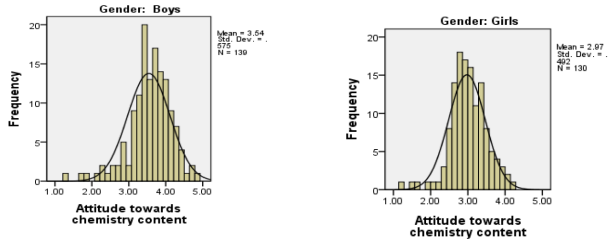
Figure 2. Histograms for Student Attitudes Towards Content



267, p = .00). Despite the fact that both sexes displayed neutral attitude towards the content of the curriculum, boys' attitudes were more positive than girls' as shown by their mean scores. This is shown in Table 5 in the appendix.

Relationship between Students' Attitude towards Chemistry Curriculum Content and Performance in Chemistry. A correlation was carried out to establish the strength of the relationship between attitude towards content and performance in chemistry based on gender. Results on the relationship between students' attitude towards content and performance in chemistry are presented in Table 6.

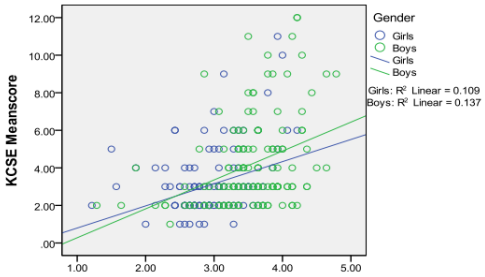
Table 6
Relationship between Attitude towards Chemistry and Performance (Boys)

	Performance	Gender
Attitude towards Content	0.37**	Boys
	0.33**	Girls

The correlation revealed a positive significant correlation between attitude towards content and performance in chemistry (r = .37 for boys, r = .33 for girls, p < .01). This shows that there is a positive relationship between attitude towards content and performance in the subject for both boys and girls. Students' attitude towards content significantly affect their performance in chemistry.

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 Figure 3.

Figure 3. Scatter Plot on Student Attitude



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.

Mochire (2010) revealed that because of the poor attitudes 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 concluded 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.

A research done by Kubiatko et al. (2017) on Czech lower secondary and secondary grammar school pupils' attitude towards chemistry revealed an overall (slightly positive) pupils' attitude towards chemistry. Girls received a lower attitude score in comparison with boys in all grades, except the first grade. 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.

Gender Differences in the Relationship between Attitude towards Content and Performance. Boys registered a higher relationship between attitude towards content and chemistry performance (r =.37 for boys, r = .33 for girls).

Gender Differences in the Relationship between Attitude towards Content and Performance. There is gender difference in the relationship between students' attitude towards content and performance. The higher relationship between performance and attitude towards content for boys translates into slightly higher performance than for girls.

Gender differences in the relationship between attitude towards content and performance. Teachers need to organize the content of the chemistry curriculum well when teaching to help girls demystify the notion that chemistry is difficult. On the other hand, boys' positive attitude towards chemistry content should be reinforced further by teachers and students at large to realize better performances in the subject.

Summary, Conclusion and Recommendations

Summary of the Findings

Boys registered a higher relationship between attitude towards content and chemistry performance (r =.37 for boys, r = .33 for girls).

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Conclusion

There is gender difference in the relationship between students' attitude towards content and performance. The higher relationship between performance and attitude towards content for boys translates into slightly higher performance than for girls.

Recommendations

The following are the recommendations of the study:

Teachers need to organize the content of the chemistry curriculum well when teaching to help girls demystify the notion that chemistry is difficult. On the other hand, boys' positive attitude towards chemistry content should be reinforced further by teachers and students at large to realize better performances in the subject.

Suggestions for Further Research

The following are suggestions for further research:

1. A similar study to explore other factors that may influence performance in chemistry, as there have been persistently low academic outcomes in this subject.

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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Appendix

Table 7
Independent Sample Test for Student Attitudes towards Content

		Levene's Test for Equality of Variances	**t-test for Equality of Means**							
		F	**Sig.**	**t**	**df**	**Sig. (2-tail**	**Mean Diff**	**Std. Error Diff**	**Lower**	**Upper**
Attitude Towards Content	Equal variances assumed	1.510	.220	8.637	267	.000	.565	.065	.436	.694
	Equal variances not assumed			8.681	264.97	.000	.565	.065	.437	.693