GENDER DIFFERENCE IN THE INFLUENCE OF SELECTED FACTORS ON SCIENCE PERFORMANCE AMONG SECONDARY SCHOOL STUDENTS IN MIGORI COUNTY, KENYA

BY

GOR POLYCARP OWINO

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SCHOOL OF EDUCATION

MASENO UNIVERSITY

DECLARATION

I declare that this is my original work and has not been presented or produced for any degree in any university.

By Candidate

Gor Polycarp Owino PHD/ED/00044/2017

Signature……………………………….. Date………………………….

This work has been submitted with our approval as university supervisors

Names of Supervisors

Prof. Lucas Othuon

Department of Educational Psychology,

Maseno University

Signature……………………………….. Date………………………….

Dr. Quinter Migunde

Department of Educational Psychology

Maseno University

Signature……………………………….. Date………………………….

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DEDICATION

This work is a dedication to my deceased father, Philip Gor Nyaimbo, my mother, Naomy Gor, my wife, Annet Owino, my son, Grahams Gor Owino and my two daughters Nomy Gracious Owino and Nina Grandy Owino.

ABSTRACT

Generally, the negative stereotyping of science as a 'male' field has seen, girls losing self-efficacy and interest in this field and hence they continue to lag behind boys in science performance. Statistics indicate that averagely in Kenya, females constitute just 29% of Science Technology Engineering and Mathematics (STEM) careers. At the university, females constitute just 30% of STEM students. Similarly, the KCSE performance for the years 2017, 2018 and 2019 indicate that boys defeated girls in all the science subjects. With an average performance in the 2019 KCSE of 22.63% for girls and 26.65% for boys indicating a gender disparity of 4.02%, Migori county performs poorer as the national disparity stands at 2.8% in favour of the boys. Consequently, Migori county performs poorer than the neighbouring counties of Kisii and Homa-Bay which registered a gender disparity of 2.86% and 3.77% respectively in favour of the boys. The purpose of this study therefore was to establish the moderating role of gender in the influence of gender stereotype, self-efficacy and interest on science performance among secondary school students in Migori county. The objectives were, to: examine the influence of gender stereotype on science performance, examine the influence of self-efficacy on science performance, examine the influence of interest on science performance and to evaluate gender as a moderator in the influence of gender stereotype, self-efficacy and interest on science performance. The study was based on a conceptual framework describing the process by which gender stereotype, self-efficacy and interest influence science performance with respect to gender. Consequently, Descriptive Survey and Correlation Designs were used. The target population for the study was 2,200, i.e. 1550 boys and 650 girls from the 240 public secondary schools in the county. Fishers et al. (1991) formula was used to arrive at a sample size of 327 which was selected using stratified, purposive and simple random sampling methods. Gender Stereotype Scale (GSS), Science Self-Efficacy Scale (SSES), Science Interest Survey (SIS), Focus Group Discussion Guide (FGDG), Science Achievement Test (SAT) and Head of Science Interview Schedule (HOSIS) were used to collect data. A pilot study was done to establish the reliability of the instruments by subjecting the instruments to 33 students using a test-re-test method that yielded a Pearson Product Moment correlation coefficient (r) of .786 for SRMS, .792 for GSS, .769 for SSES, .780 for SIS and .782 for SAT and were deemed to be reliable as a r of .70 and above was achieved for all the instruments. Experts in the Department of Educational Psychology, Maseno University advised on the content validity of the instruments. Quantitative data was analyzed using Descriptive Statistics, Correlation analysis, Simple and Multiple Linear Regression Analysis that included frequencies, means, percentages, variance, covariance, correlations and regression estimates. Qualitative data from FGDG and HOSIS was organized into emergent themes and reported. The study revealed that gender stereotype significantly predicts performance in science $b = -4.917$ (p=.013, 327). Further, self-efficacy significantly predicts science performance b=5.896 (p=.026, 327). In addition, interest predicts science performance b=4.653 (p=.001, 327). However, gender only moderates the relationship between interest and science performance with $b = 8.6149$, 95%CI (-1.4566, 18.6864), t=1.6885, $p < .05$. The relationship is significantly higher among females at $b = 9.892$, 95%CI (2.2487, 4.8067), t =2.152, $p < .05$ than males at $b = 5.989$, 95%CI (2.1526, 22.1325), t =2.965, $p < .05$.. It is concluded that gender stereotype, self-efficacy and interest influence science performance and that gender only moderates the relationship between interest and science performance. Therefore, the study recommends that in order to reduce the gender disparity in science performance, the level of interest in science and self-efficacy should be enhanced, particularly for the females through intrinsic motivation. Consequently, the negative gender stereotype beliefs should be demystified. The findings are significant to the students, teachers and the government in improving gender parity in science performance for enhancement of STEM performance.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA	:	Analysis of Variance
CDE	:	County Director of Education
CUE	:	Commission for University Education
DV	:	Dependent Variable
FDG	:	Focus Group Discussion
FGDG	:	Focus Group Discussion Guide
G & C	:	Guidance and Counseling
GPA	:	Grade Point Average
GSS	:	Gender Stereotype Scale
HIV/AIDS	:	Human Immune-Deficiency Virus/ Acquired Immune Deficiency Syndrome
IV	:	Independent Variable
KCSE	:	Kenya Certificate of Secondary Education
KMPDB	:	Kenya Medical Practitioners and Dentist Board
MUERC	:	Maseno University Ethics Review Committee
SAT	:	Science Achievement Test
SD	:	Standard deviation
Sig.	:	Significance level
SIS	:	Science Interest Survey
SPSS	:	Statistical Package for Social Sciences
SRMS	:	Science Role Model Scale
SSE	:	Science Self-Efficacy
SSES	:	Science Self-Efficacy Scale

STEM	**:**	Science Technology Engineering and Mathematics
UNESCO	:	United Nations Educational, Scientific and Cultural Organization
USA	:	United States of America
VIF	:	Variance Inflation Factor, collinearity diagnostic factor that helps identifying multicollinearity between measured concepts

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

This chapter contains background information presented in the following order: Background of the study, statement of the problem, purpose of the study, objectives of the study, hypotheses of the study, assumptions of the study, scope of the study, limitations of the study, significance of the study and conceptual framework.

Gender differences in Mathematics and science subjects still remains to be a major problem in classrooms (Diane, 2003). Studies have consistently shown that in spite of the improvements witnessed in the past two decades, girls still shy away from taking Physics and higher-level Mathematics and science courses in high school. In a nutshell, this field has become a preserve of the male gender. Consequently, we may end up having fewer female students studying Mathematics and science at the college level of education which may greatly interfere with the uptake of science careers by the female gender. (Diane, 2003).

There is dire inadequacy of labour force in the Science, Technology, Mathematics and Engineering (STEM) field. United Nations Educational, Scientific and Cultural Organization (2018) shows that women form a paltry 28 percent of researchers globally. This has been occasioned by the fact that right from the school years, women have shunned this field and therefore few of them enroll for this field. Consequently, socio-cultural, labour market demands as well as societal expectations all come into play in influencing this fact (UNESCO, 2016).

In a report by Statistics Canada (2007) carried out in the year 2007, a grim picture is painted of this sorry state of affairs. The report showed that in the field of Mathematics, Engineering and Natural Science, women only formed 22% of the professionals which signaled a dismal growth of

2% from the year 1987. With the continued low enrollment of women in this field, there seems to be no significant improvement in the near future (Fried & MacCleave, 2009; Statistics Canada, 2007). Similarly, in Europe and the United States where the workforce is shared equally across the gender at 50% each, it is quite ironical that in the science careers, we only have 15% being women (Weinburgh, 2000).

This state of affairs is replicated across the globe. For instance, in Europe where women account for over 50% of total students, only 11% of females have enrolled in the top science careers (Dewandre, 2002; European Commission, 2009). In the workforce that is comprised of 52% women, it is sad that in the fields of scientist and engineering, we only have 32% women. Europe has tried to encourage women to obtain doctoral degrees which has actually worked in the humanities and life sciences. A total of 41% PhD graduates in this field are now women. However, for the Physical science and Engineering, we only have 25% of PhD graduates being women (European Commission, 2009). Female scientists have blamed this on gender discriminations in the society (Baker & Leary, 2003; Ceci & Williams, 2007).

Studies conducted in Nigeria however have not been conclusive as they give conflicting results. Researchers here say that gender differences no longer exist as a significant factor in the science field and that gender parity has actually been attained in this field\ (Abayomi & Mji, 2004; Bilesanmi- Awoderu, 2006 & Din, Ming & Ho, 2004). Female students are now being encouraged to go for the science subjects just like their male counterparts. Consequently, other studies have revealed that the male gender is in fact being disadvantaged in the science field due to the constant support of the female gender (Omoniyi, 2006). However, studies by Eriba and Sesugh (2006) conducted in the region have revealed male advantage in integrated science and mathematics achievements.

In Uganda, results of studies show that women continue to perform poorly in the science field as compared to the male gender which limits the enrollment of female in the science-oriented courses such as computer (Ochwa-Echel, 2011). The study further posits that although there has been some slight show of concern by education stakeholders and leaders, their effort has borne very little fruit as there has been no major steps towards the implementation of the policies aimed at bringing gender parity in science. Women as such remain left out in the field of science and their effort is therefore not fully exploited.

The situation in Kenya is no better as recent literature continue to depict this gender inequality in the field of science in terms of performance. Results indicate that the girl-child is quite disadvantaged in terms of the level of science performance in comparison with the males (Forum for African Women Educationalists, 2008). A study by Wambua (2007) affirms this position as it found that boys have a better STEM performance than the girls. Eventually, this lower STEM performance will translate to fewer women in the STEM careers (FAWE, 2008).

Ultimately, this skewed performance in STEM subjects eventually results to underrepresentation of women in the STEM field. UNESCO (2018) survey affirms this position. The study established that indeed there is a gender gap in the science field. For example, 35% of the 6,664 Kenya Medical Practitioners and Dentists Board (KMPDB) registered doctors and dentists by the year 2018, females constitute just a third. Consequently, the survey revealed that in the field of research we only have 14% females and in the field of engineering and technology we have 11% females. Likewise, it is quite ironical that women constitute a third of agricultural scientists yet they make up 80% of the farm labour in Kenya.

A similar situation is witnessed in the Kenyan universities. The figures from the Commission for University Education indicate that 33% of university students enrolled in STEM courses are women. The percentage varies according to the field of study. For instance, in 2015, at the undergraduate level, the survey indicated that there was a very significant gender disparity in favour of the males in the fields of: Manufacturing at 16%, Engineering at 17% and Computing at 22%. However, gender parity was almost achieved in the field of health and welfare cluster at 49% (CUE, 2018).

Consequently, at the Kenya Certificate of Secondary Education (KCSE) level, boys perform better than girls in Science and Mathematics. In 2019 boys defeated girls in all the science subjects. In the 2018 Kenya Certificate of Secondary Education examination, girls defeated boys in Metal Work only and trailed the boys in the other science and technology-related courses, including Biology, Chemistry, Computer Studies, Electricity, General Science, Mathematics, Physics, Power Mechanics, Agriculture, and Aviation. A similar result was evident in the 2017 KCSE results where, of the examinable subjects, boys scored better than girls in 23 subjects, defeating girls in all Sciences. Girls only defeated boys in the 6 subjects of; English, Kiswahili, CRE, Home Science, Art, and Design and Electricity (KNEC Report, 2019).

Specifically, Migori county has not done any better in terms of science performance as well. Migori county had girls scoring an average mark of 22.63% for all sciences against the boys' 26.65%, giving a gender disparity of 4.02%. Consequently, just 10. 22% of the girls in comparison with 20.46% of the boys who sat for the 2019 KCSE examination did all the 4 Science subjects (Migori County Education Office Records, 2019). This further worsens the negative gender beliefs attached to the science subjects as being a preserve of the male gender.

This performance by Migori county is quite weak when compared with the neighbouring counties or national performance. For instance, the neighbouring counties of Kisii and Homa-Bay registered a gender disparity of 2.86% and 3.77% respectively in favour of the boys which is lower than the figure for Migori county of 4.02%. Consequently, the national disparity in science stood at 2.80% in favour of the boys which is again lower than the figure for Migori county at 4.02%. Migori county therefore risks lagging behind in the field of science, since STEM subjects are the major pillars of medical research, food management, industrialization, environmental conservation, and improved agricultural production. It is for this fact that the current study set to investigate the causal factors that necessitate this gender disparity in science performance to ensure an improvement in STEM subject for both gender but more particularly, the female to ensure the attainment of the Millennium Development Goals.

While some studies indicate a male advantage in mathematics and science (UNESCO, 2018; Otieno, 2019; FAWE, 2008; Wambua, 2007; Organization for Economic Co-operation and Development [OECD], 2015; Migori County Education Office Records, 2019 and CUE, 2018); other studies show that female students perform equally as well or even better than male students in mathematics and science (Cotton, McIntyre, & Price, 2013; O'Grady & Houme, 2014 : Abayomi & Mji, 2004; Bilesanmi- Awoderu, 2006; Din, Ming & Ho, 2004 & Voyer & Voyer, 2014). Based on these conflicting findings, one cannot authoritatively assert that females perform poorly in sciences than males. It is for this that the current study sought to establish the gender disparity in performance of sciences by subjecting students in Migori county to a science achievement test with a view to examining how the selected factors influence the science performance.

A possible explanation to this gender difference in performance of the science subjects is that the female gender is subjected to negative gender stereotype beliefs that depict the field of science as a preserve of the males. Henceforth, the study reckons that female students feel that the STEM courses and careers are not suitable for them. In the long run, they end up failing in such areas. (Truscott, 2017). It is quite sad that the current society still considers science as a masculine field (Fox et al., 2006; Hill et al., 2010). This is particularly wrong as science shows that there is no major biological difference between the males and the females (Blickenstaff, 2005; Francis & Skelton, 2005; Murphy & Whitelegg, 2006).

According to the Cognitive theories, young children begin by understanding and differentiating themselves as either males or females based on their biological make up (Martin, Ruble, & Szkrybalo, 2002). At the initial stage, the child learns that he/she is either male or female based on the sex organs. Cultural and societal beliefs then begin to build upon these characterizations which then forms gender identity of what it is to be male or female. Social comparison is a positive aspect as one compares himself/herself with others thereby getting to understand themselves better as well as those around (Wood & Eagly, 2015). These studies allude to the fact that a child lives in a society and not as a single unit and therefore the society has a lot in terms of shaping an individual.

Ultimately, when one makes social comparison with those on a higher hierarchical order, they get motivated to achieve the standards set by their objects of admiration especially if their level of self-efficacy is high. Hoyt (2013) reckons that when students are able to see similarities between them and those whom they consider as their role models, they see the standards set by these individuals as achievable. Murphy and Whitelegg (2006) opine that it is particularly sad that the girls would avoid taking certain masculine tasks especially if their upward comparisons or role models don't excel in such activities. This is in spite of the fact that they could well accomplish the tasks therein (Belkin, 2008 & Hill et al., 2010).

Research by UNESCO (2016) in Latin America indicate a number of societal obstacles for women in science. The study opined that these hurdles relating to work life and societal disadvantages for women bar their good performance in science. The societal expectation is that women and girls should manage the household and not compete in science with men. They therefore have to put extra effort in order for them to be at the level of men or to succeed in science. In a nutshell these gender issues can leave the female student feeling quite incompetent and unable to successfully accomplish scientific tasks (Else-Quest et al., 2010; Francis & Skelton, 2005 & Hill et al., 2010).

The lack of women in science will therefore still be a persistent problem today because of the lack of female representation at the higher level of PhD or senior administration (Belkin, 2008; Burrelli, 2008; Ceci & Williams, 2007; Hede, 2009; Heilbronner, 2008). Consequently, it is ironical that some exceptionally good women in science drop out of the science field and thereby leaving men to remain outstanding in this field. Such women drop out of science careers or change careers regardless of their exceptional abilities that even outstand the men they leave in the field. This is occasioned by the very negative stereotype beliefs that totally discriminate against the female gender in this field (Baker & Leary, 2003).

Consequently, gender stereotype is witnessed at the subject level as well. Physics for instance has and continues to be one of the most gender stereotyped subjects. The students as well as the society categorizes the subject as a male subject. This therefore makes the female students to shy away from taking the subject (Carlone, 2003). For girls to succeed in Physics and other science subjects they therefore believe that they need to adopt masculine abilities (Mrazek & Howes, 2004);

inability to do this therefore translates to lower self-efficacy in the field of science (Bandura et al., 2001). In order to continue being attractive to men, female teenagers seek to acquire feminine attributes which majorly discriminate against science (Barnett & Rivers, 2004)

Gender bias and discrimination is still a common thing in Nigeria and perhaps Africa as a whole. Arigbabu and Mji, 2004) and. Onyeizugbo (2003) affirm this by stating that, "sex roles are rigid in Africa, particularly in Nigeria where gender differences are emphasized." Gender stereotype statements have become a common thing in society and therefore no longer attracts any condemnation and hence this provides fodder for their growth. Some professions and vocations (engineering, medicine and architecture) are considered to be for men while others like nursing, typing, catering and arts are taken as women careers. Even though these rigid sex roles are held more by males than females, the patriarchal nature of the society forces females to internalize and accept them as truths.

FAWE (2003a) and Ayoo (2002) bring out the gender stereotype beliefs that work against girl performance in school. Their studies assert that gender stereotypes are mainly in favour of boys in Kenya and the girl-child is left to battle it out alone in a male dominated field of academics. As such, with the negative gender stereotype beliefs being in favour of the boys, they end up becoming more gender stereotyped than the females. In a study in Baringo district secondary schools, Chepchieng and Kiboss (2004) found that girls suffered from lack of adequate time to concentrate on their academic work unlike the boys who did not do domestic chores and therefore had sufficient time to concentrate on their academic work.

Gender stereotype beliefs create barriers for girls in sciences and therefore they feel incompetent and unable to perform well in this 'male field' which is as a result depicted in low female performance in STEM (Barnett & Rivers, 2004; Mrazek & Howes, 2004; UNESCO, 2016; Blickenstaff, 2005; Francis & Skelton, 2005; Murphy & Whitelegg, 2006; Belkin, 2008; Fox et al., 2006 & Hill et al., 2010). These studies further posit that gender stereotype beliefs are dependent on cultural and societal norms of a particular society. Since the studies were all based in the Western countries, their cultural connotation on gender cannot be assumed to be similar to African values attached to gender for their findings to be generalized as reflective of the local scenario. This therefore called for a similar study in the local environment.

A solution to this gap was somewhat captured in Arigbabu and Mji, (2004); Onyeizugbo (2003): FAWE (2003a) and Ayoo (2002) studies which looked at gender stereotype beliefs in Africa and how they influence STEM career choice and academic performance in general. The studies thus failed to address performance in sciences in particular and it is therefore for this and the afore-cited gap that the current study sought to fill these knowledge gaps.

Stout, Dasgupta, Hunsinger and McManus (2011) reckon when one has same sex role model then their level of self-efficacy becomes higher as they actually see that the tasks called for in a particular field is actually achievable. Consequently, the stereotype beliefs are central in determining the level of self-efficacy and interest towards STEM. With fewer female role models in STEM and negative stereotype beliefs towards female, the girl student is likely to lose confidence and interest in the STEM field (Stout et al., 2011). Zeldin and Pajares (2000) posit that vicarious experiences (viewing of role models) and verbal persuasions (believing societal norms and values) are major factors in self-efficacy beliefs and interest in women. (Shin, Levy, & London, 2016).

Self-confidence which ideally is an aspect of self-efficacy, explains course selection process which may lead to few women selecting certain careers and subjects due to their low level of confidence in tackling certain scientific tasks. Consequently, belief by women that they are not capable of undertaking certain tasks may eventually lead to lower performance in science subjects (Corbett, Hill & Rose, 2008). Previous research has established a relationship between science self-efficacy and Science achievement and Science-related choices. At the high school level, the level of a student's self-efficacy greatly influences a student's level of achievement than gender, ethnicity, and parental background combined (Kiperman, 2002; Lau & Reeser, 2002).

According to Titilayo, Oloyede and Adekunie (2016), self-efficacy gives the level at which a student or pupil believe they can successfully post a good performance in school. Their study asserts that self-efficacy usually correlates with outcome expectations which in these studies was performance in chemistry exams at the senior school exams. A relationship was therefore established between self-efficacy and the outcome expectation of Chemistry performance.

Ochieng (2015) in his study was able to give the central role of self-efficacy in academic performance. The results from gender perspective revealed that males had a higher level of Self–Efficacy than their female students. His study further revealed a statistical level of significance in this difference. The boys were able to display a lot of confidence in tackling Mathematical related tasks unlike their female counterparts who were somewhat doubtful of their capabilities. Finally, the study findings further indicated that the level of self-efficacy greatly influences performance as those who displayed higher levels of self-efficacy were able to post good results.

While some studies showed a relationship between self-efficacy and performance in science (Corbett, Hill & Rose, 2008; Kiperman, 2002; Lau & Reeser, 2002 & Ochieng, 2015); others have shown no significant relationship between these two constructs (Titilayo, Oloyede & Adekunie, 2016). Based on these conflicting findings, one cannot conclusively posit whether or not self-efficacy influences science performance. It is therefore this discrepancy that the current study sought to solve.

Consequently, Corbett, Hill and Rose (2008); Kiperman (2002) and Lau and Reeser (2002) assessed the relationship between self-efficacy and Physics; Titilayo, Oloyede and Adekunie (2016) looked at self-efficacy and Chemistry while Ochieng (2015) investigated the relationship between self-efficacy and Mathematics. These studies thus failed to look at all the science subjects but merely focused on one subject then generalized the findings for all the other sciences. This may lead to inaccurate finding as each science subject is unique in its own way. This study therefore sought to fill this gap by looking at self-efficacy in comparison with all the 4 science subjects.

Consequently, research has shown a key role played by interest in determining the level of performance. Research has it that the more one is interested in a subject the more he/she is able to display dedication resilience and competence towards the subject (Winne & Nesbit, 2010). It therefore implies that interest helps in shaping mental preparedness in tackling a subject. Research posits that individual and situational interest promote attention, recall, task persistence, and effort. Despite this fact studies still show that there is huge gender disparity in the level of interest (Hidi & Renninger, 2006).

Adekunle and Femi-Adeoye (2016) quotes from Encarta Dictionary (2004) that, "interest is a feeling of curiosity or concern about something that makes attention turn towards it." They opined that, "Personal interest develops slowly and tends to have long-lasting effects on a person's knowledge and values, whereas situational interest is an emotional state that is evoked suddenly by something in the immediate environment and that may have only a short-term effect on an individual's knowledge and values.

Situation interest is aroused as a function of the interestingness of the content and context and partially under the regulation of teachers." In their study on relationship between interest and academic performance in Biology among senior secondary school students, Adekunle and Femi-Adeoye (2016) were able to establish statistical significance in the relationship between student's interest in Biology and student's academic performance in Biology (Adekunle & Femi-Adeoye (2016).

Rautta (2013) in a study in Nairobi county affirms the position held by Adekunle and Femi-Adeoye (2016) that indeed interest influences the performance in sciences. The study went further to include the gender variable in this relationship. The study established that the more interest a student puts on a particular subject, the higher his/her level of performance in that subject as he or she will dedicate effort and time to it. The study found that majority of the boys qualified to join the science-based courses while majority of girls qualified for enrolment in Art based courses. The interest in science subjects was also high among the male students as compared with female students.

Having an interest in a subject leads to positive performance in that subject (Winne & Nesbit, 2010 & Hidi & Renninger, 2006). These studies opined that there is a relationship between interest in science and science performance. Despite making these assertions, these studies failed to do a correlation test to establish the existence of the relationships and instead relied on beliefs from students that interest would impact on their science performance.

An attempt to empirically establish the relationship is found in Adekunle and Femi-Adeoye (2016) and Rautta (2013) studies. However just like the afore-cited Winne and Nesbit (2010) and Hidi and Renninger (2006) which looked at Science in general, these two studies looked at Biology and overall performance respectively. With all these studies failing to look at interest in relation to all the four science subjects, there is thus a knowledge gap left. It is this gap that this study sought to bridge.

The current study focused on these 3 selected variables of gender stereotype, self-efficacy and interest since they have shown to influence performance in sciences (Truscott, 2017; Baker & Leary, 2003; Belkin, 2008; Burrelli, 2008; Ceci & Williams, 2007; Hede, 2009; Heilbronner, 2008; Barnett & Rivers, 2004; Mrazek & Howes, 2004; UNESCO, 2016; Blickenstaff, 2005; Francis & Skelton, 2005; Murphy & Whitelegg, 2006; Belkin, 2008; Fox et al., 2006; Hill et al., 2010; Corbett, Hill & Rose, 2008; Kiperman, 2002; Lau & Reeser, 2002 & Ochieng, 2015).

However, these previous studies have looked at these relationships separately. They have either looked at gender stereotype, interest and self-efficacy as individual independent variables influencing the Science performance with limited evidence of studies looking at the 3 variables at once as all exogenous factors that all influence science performance. The current study therefore filled this gap by coming up with a model of the three independent variables influencing the science performance at once. The study introduced gender as a moderator to the model to further establish how gender would alter the influence in the model which was not done by the afore-cited studies. The study went further to establish whether this proposed framework could be a better model to explain this relationship or modify the model if it doesn't best describe the relationship through the use of Moderated Regression Analysis in order to establish the most parsimonious model for the study.

1.2 Statement of the Problem

The performance of females in the STEM field continues to be poor in comparison with that of the males. Studies indicate that the negative gender stereotype beliefs in science have translated to lower levels of self-efficacy and interest among females in the field. This has seen fewer women excel in in the field of science. A look at all stages right from the secondary school level all the way to managerial level reveal STEM as a masculine sector with females being under represented at each stage. For instance, data from the Kenya National Bureau of Statistics (2019) indicate that in general, in Kenya, the number of females in STEM professions is 21,400 in comparison to males who make up 52,400. At the university, females constitute just 30% of STEM students.

This weak representation of females in science is again reflected in the performance of sciences down the ladder. The KCSE performance for instance attest to this worrying trend as boys have had a better performance than girls in all the Science subjects from the year 2017 to 2019. The STEM performance has not been any better in Migori county as well. Although the average national result of all Science subjects in the 2019 KCSE exams gave a gender disparity of 2.8% (males scored 27.78% while females scored 24.98%), Migori county had a gender disparity of 4.02% (girls scored 22.63% while boys scored 26.65%).

Likewise, Migori county performs poorer in comparison with the neighbouring counties. For instance, the neighbouring counties of Kisii and Homa-Bay registered a gender disparity of 2.86% and 3.77% respectively in favour of the boys which is lower than the figure for Migori county of 4.02%. This goes against the Millennium Development Goals which advocates for gender parity in STEM performance and promotion of STEM subjects for attainment of Vision 2030.

This worrying trend is against a backdrop of a number of measures put forward by the government of Kenya, other development partners and stakeholders. Such measures, include among others; the ministry of education lowering university entry grade for girls and the Teachers Service Commission ensuring that a female is included in the administration of any school with female students. A number of NGOs such as the Dream Girl and Liverpool Voluntary Counselling and Testing (LVCT) Health in Migori county offer scholarships for girls as well as take them through regular motivational workshops in a bid to ensure they are in school so that they effectively compete with the boys. However, despite all these measures gender disparity in science performance still persists. It is against this backdrop that the current study sought to investigate the moderating role of gender in the influence of gender stereotype, self-efficacy and interest on science performance with a view to improving the performance in sciences by seeking to eliminate the gender disparity in performance.

1.3 Purpose of the Study

The purpose of this study was to establish the moderating role of gender in the influence of gender stereotype, self-efficacy and interest on science performance among secondary school students in Migori county.

1.4 Objectives of the Study

The study was guided by the following objectives;

1. To examine the influence of gender stereotype on science performance.
2. To examine the influence of self-efficacy on science performance.
3. To examine the influence of interest on science performance.
4. To evaluate gender as a moderator of:

    4.1 The influence of gender stereotype on science performance.

    4.2 The influence of self-efficacy on science performance.

    4.3 The influence of interest on science performance.

1.5 Hypotheses of the Study

The study was guided by the following null hypotheses;

H_{01} Gender stereotype has no significant influence on science performance.

H_{02} There is no significant influence of self-efficacy on science performance.

H_{03} Interest has no significant influence on science performance.

H_{04} Gender has no significant moderation on:

$H_{04.1}$ The influence of gender stereotype on science performance.

$H_{04.2}$ The influence of self-efficacy on science performance.

$H_{04.3}$ The influence of interest on science performance.

1.6 Assumptions of the Study

The study made the following assumptions:

1. That all the form 4 students in the county have successfully gone through the forms 1 and 2 syllabi for science subjects and can therefore effectively answer the content of the test.
2. That the Science Achievement Test without the practical element in it reflects the students' true ability in sciences.

3. That the performance in the Science Achievement Test which is drawn from the form one and two syllabi reflects a true performance of the whole secondary school syllabus of the four years.
4. That the selected heads of science department have adequate knowledge about the four science subjects and therefore give correct and unbiased information about the four subjects.

1.7 Scope of the Study

This study focused on the 2020 form four students in Migori County. The form four class was chosen since they have gone through enough training on various science subjects and have covered the form 1 and 2 syllabi and therefore were at a position of effectively answering the questions in the Science Achievement Test whose content was drawn from the KCSE questions covering forms 1 and 2 syllabi. Consequently, the form four class was chosen since they have done the subject selection and therefore provided the needed cohort for the study as the study required only those who had selected all the science subjects.

The study also focused on Heads of Science Departments in Migori county. The HOSD were chosen because they have a better understanding of performance of all the 4 science subjects being the overall heads of all the sciences. Consequently, they would be in a position to give a more in-depth qualitative data to back up the quantitative data got from the questionnaires. Not all factors that may affect Science performance such as school resource factors, parental factors, career choice, teacher commitment, school history etc. were looked into. The current study solely focused on the influence of gender stereotype, self-efficacy and interest on science performance.

1.8 Limitations of the Study

The study had the following limitation:

Since the Science Achievement Test only tested the theoretical aspect of the science subjects and left out the practical segment, the results of the test particularly for the 3 science subjects of Chemistry, Biology and Physics could be inconclusive as the practical segment makes a significant part of performance. Responses from the Heads of Science Department and Focus Group Discussion Guides were used to try and address this limitation by giving the overall level of science performance with the practical segment in it.

1.9 Significance of the Study

The current study sought to establish the barriers to girls' good science performance in form of the negative societal gender stereotype beliefs that depict the field of science as a preserve of the male gender. The findings would therefore be very useful to the students, teachers, Ministry of Education and the society at large as it may be used to demystify the existing gender stereotype beliefs with the aim of increasing the number of females in the science field for the attainment of Kenya's Vision 2030.

The study also sought to investigate the level of learners' confidence in tackling science related tasks. The findings would therefore be useful to both teachers and students as it would seek to provide ways of improving confidence in science, particularly for female students who have consistently shown a weaker science performance. The findings would also be useful to curriculum developers and teacher trainers as it may be used to develop content and methodology that may increase learners' level of confidence in science with a view to improving science performance.

Consequently, the study also sought to examine the influence of interest in science on science performance. The finding would therefore be useful to curriculum developers, parents, teachers and students as it may be used to improve the level of interest in science for both the gender to ensure an increase in science performance, particularly for the females by coming up with ways of making science an exciting field for them. This would as such lead to gender parity in science and hence attainment of the MDGs.

The study also looked at Science performance as a latent factor indicated by various observed variables, which are the four Science subjects. The result of analysis would therefore give the magnitude of performance for each Science subject. This data would therefore be useful to curriculum developers, teachers, Ministry of Education and other education stakeholders as it may be used as a basis for instigating measures of addressing the problem in the poorly performed subjects.

1.10 Conceptual Framework

The study's conceptual framework is based on the belief that the external factor of gender stereotype and the internal factors of self-efficacy and interest have the ability of interacting to produce a desired outcome which in the current study is science performance. The framework conceptualizes that the three factors of gender stereotype, self-efficacy and interest all come together in the process of influencing the level of science performance and that gender has the ability to alter the level of this influence.

Science performance has, and still continues to be a problem in terms of gender disparity (Diane, 2003). Research has been able to show that boys perform considerably better than girls in science (Aurah, 2017). An evidence of this sorry state is found in the KCSE performance of the years 2017 to 2019, whose results have shown that girls have not performed better than boys in even a single Science subject and have only managed to outshine boys in some Art and Technical based subjects (KNEC Report, 2019). The scenario was the same in Migori county which registered a gender disparity in the average performance of all science subjects of 4.02% in favour of the boys (Migori County Examinations Office, 2019).

The huge gender gap in Science could be as a result of the negative stereotype against females in science. Girls get affected by the negative gender stereotype beliefs that discriminate against them in the field of science. Consequently, this affects female science performance since girls are made to believe Science is a masculine discipline and that girls cannot be good at STEM subjects (Belkin, 2008; Bleeker & Jacobs, 2004; Fox et al., 2006). Stout, Dasgupta, Hunsinger and McManus, (2011) and Winne and Nesbit (2010) reckon that favorable gender stereotype is likely to be a strong source of self-efficacy and interest whereas negative gender stereotype is likely to lower the levels of self-efficacy and interest. Consequently, higher levels of self-efficacy and interest and lower levels of gender stereotype translate to better academic performance and vice versa (Bandura, 1986; Hoy, 2004).

The study's conceptual framework in Figure 1 therefore reflects the assumption that gender has the ability to alter the influence of gender stereotype, self-efficacy and interest on science performance. The framework has 3 independent variables: self-efficacy, interest and gender stereotype, one dependent variable: Science performance and one moderating variable: gender. All the 3 independent variables are conceptualized as influencing the dependent variable.

Therefore, if the introduction of gender is able to significantly alter the initial level of influence between the various independent variables and the dependent variable then we say that the variable gender moderates the relationship between the independent and the dependent variable. The study sought to test the relationship in the conceptual framework with a view of coming up with the most parsimonious model for this study.

The conceptual framework is as shown below:

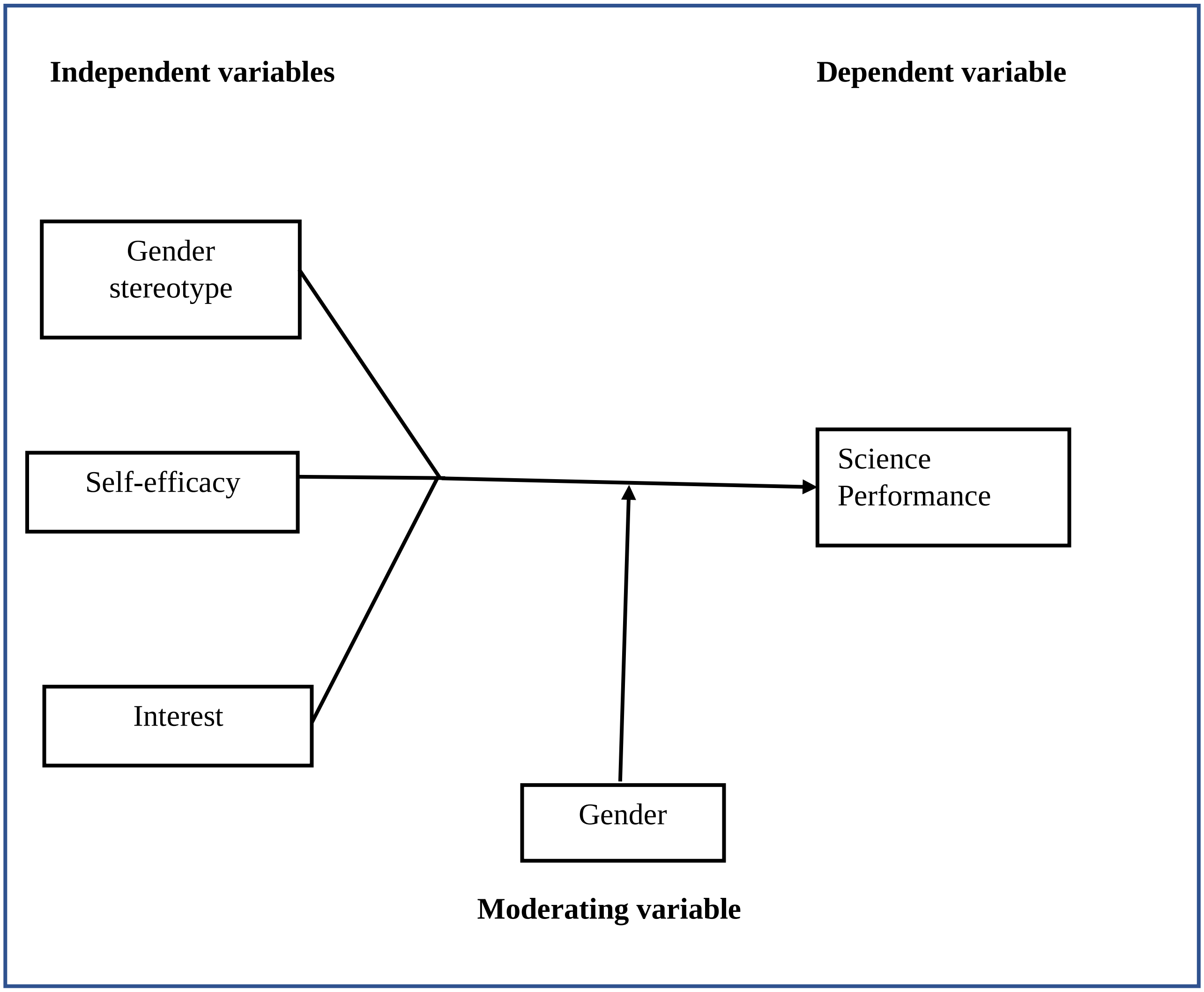

Figure 1.1: A conceptual framework showing the process by which gender stereotype, self-efficacy and interest influence Sciences performance with respect to gender.

1.11 Definition of Key Operational Terms

The following terms were defined as used in this study:

Gender: -Belonging to a category of either male or female.

Gender Stereotype **-**Generalization about the gender attributes, differences and roles of individuals/groups.

Intelligence **-**This is the level of Intelligence Quotient.

Interest **-**A great attention or liking towards science subjects.

Moderating effect **-** Ability of a variable to influence the level of an existing relationship by being able to alter the ininitial level of relationship before the introduction of the gender variable.

Role Model **-**Availability of a person looked to by others as an example in Science to be emulated.

Sciences **-** Include Mathematics, Biology, Chemistry and Physics.

Science performance- Grade attained in science subjects.

Selected Factors -Include gender stereotype, self-efficacy and interest.

Self-efficacy **-**The level of confidence a student has in his/ her ability to successfully accomplish a given task in Sciences.

Self-Esteem **-**The feeling of worthiness by an individual.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

The literature review was presented in 4 sub-headings based on the study objectives namely: Influence of gender stereotype on science performance, influence of self-efficacy on science performance, influence of interest on science performance and gender as a moderator of the influence of gender stereotype, self-efficacy and interest on science performance.

2.2 Influence of Gender Stereotype on Science Performance

Spelke (2005) study asserted that biologically there is no major distinction between males and females in terms of science ability and that both males and females are equally endowed in science ability. The difference in science performance can therefore be as a result of societal factors but not biological ones. This position is supported by the findings of Murphy and Whitelegg (2006) which established that girls avoid subject tasks that they consider to be associated with men. This they do regardless of the fact that they could be quite competent enough to carry out those tasks. Students in Gilbert (2001) study reported that females who show prowess in science are considered as being similar to men and those teenage girls who harbor attraction to boys would therefore rather display feminine characteristics that completely excludes science.

Brickhouse et al. (2000) in a study on effect of gender stereotype on science subjects found a worrying revelation from an interview schedule. In an interview with a boy student, the study found that the male students had very negative view of their female students. The boy felt that that the female students did not rightfully belong to the science classes and that their only duty in the class was to create some environment of beauty. The study found a direct link between such negative gender stereotype comments and poor girl performance in science. Such comments were also blamed for the fewer number of girls in science classes. Although Spelke (2005); Murphy and Whitelegg (2006); Else-Quest et al. (2010); Gilbert (2001) and Brickhouse et al. (2000) established a negative relationship between gender stereotype and science performance, their findings failed to address the relationship that exist between gender stereotype and each science subject as their studies considered science as a single subject. The current study therefore did a multiple regression analysis to determine this relation with respect to individual science subject.

Huguet and Regner (2007) study concurs with these findings as the study posited that negative gender beliefs interferes with female performance. However, the study reckoned that a higher level of role model can reduce the level of gender stereotype and vice versa. (Stake, 2003, p. 669). Huguet and Regner (2007) and Stake (2003) studies however focused on general female performance thereby leaving out science performance. The findings can therefore not be taken to be adequately addressing the intent of the current study, thereby necessitating the current study.

Consequently, the stereotype beliefs are quite in favour of the boys in the field of science. This increases the boys' level of activity towards science-oriented tasks. The increased activity in the end translates to good performance in terms of working hard (Raviv et al. 2003). Conversely, gender stereotypes depict women as unfit for science. This thus leads to weak performance among girls in Mathematics. This study focused on Mathematics alone and therefore left out other science subjects. The current study however focused on Mathematics and other sciences to establish the influence of gender stereotype on performance of all sciences.

Studies also show that gender bias is quite prevalent in Nigeria and Africa as a whole (Arigbabu & Mji, 2004). This view is also held by Onyeizugbo (2003) who stated that "sex roles are somewhat rigid in Africa, particularly in Nigeria where gender differences are emphasized". In

Nigeria, gender stereotype has become a normal thing to such an extent that some careers have been categorized purely as male careers.

Students form gender stereotype beliefs and begin to categorize themselves in terms of gender. Science subjects have been stereotyped as male subjects. Eventually this translates to poor performance in math and science among girls as they see these subjects as a preserve for males (Arigbabu and Mji, 2004). Arigbabu and Mji (2004) and Onyeizugbo (2003) focused on teachers alone as the perpetuators of gender stereotype in science and therefore left out other possible causes of gender stereotype. The finding therefore was inconclusive in terms of looking at the gender stereotype in science as a factor beyond the teacher alone. The current study therefore bridged this gap by looking at general societal gender stereotype in science rather than focus on a single source.

Kakonge (2000) did a study on the role of gender stenotype on academic achievement. The study found out that teachers hold very negative perceptions on female students on their ability to perform well in science. According to the study the teachers felt that female students were not as good as male students in science. In the long run the teacher's perception directly influenced science performance of student. Just like the afore-cited studies, Kakonge (2000) also focused on teachers alone as the perpetuators of gender stereotype in science and therefore left out other possible causes of gender stereotype. The finding was therefore inconclusive in terms of looking at the gender stereotype in science as a factor beyond the teacher alone. The current study therefore bridged this gap by looking at general societal gender stereotype in science rather than focusing on a single source.

Studies have also depicted girls as having very low self-image of themselves. The negative gender stereotype beliefs have made the girl child lose confidence in their abilities. In Kenya this is particularly evident in the uptake and performance of the Physics subject. The subject has been perceived by females as being too technical; for them and therefore very few enroll for it and even those who end up enrolling for it end up performing poorly. This reflects itself in poor female performance in such areas regarded as a 'preserve of males' (Kashu, 2014). This study however only focused on Physics alone which cannot be said to reflective of all the other science subjects. The current study therefore addressed this knowledge gap by considering all the 4 sciences.

2.3 Influence of Self-Efficacy on Science Performance

The science and Mathematics field is characterized by a lot of gender stereotype issues (Diane, 2003). In spite of the strides made so far in the past 2 decades the female student still finds it difficult to pursue the field of Physics and high order science (Diane, 2003). Therefore, fewer females are able to join science courses at the college and university level as a good science score in the science subjects at the high school level is a major factor considered during college placement (Diane, 2003).

Research has continued to show that males perform in science subjects better than the female students. (Corbett, Hill & Rose, 2008). This is brought by the fact that male students are generally given more support both at home and at the school level thereby having an advantage over the female student (Schiebinger, 2001). Consequently, studies have indicated that males and females have different levels of academic self-efficacy (Simpkins, Davis-Kean, & Eccles, 2006). Males generally rank highly in self-efficacy in science than the female students. This could be partly explained by the positive gender stereotype attached to the male gender in the field of science (Simpkins, Davis-Kean, & Eccles, 2006). The afore-cited studies looked at science as a single subject. This may lead to generalization of data which could be misleading as each science subject is unique in its own way. The current study therefore looked at the performance of all science subject against the level of self-efficacy.

Parental involvement in the life of a student cannot be over looked as well. Studies have shown that the parents offer a lot of support to the male children in order for them to excel in the field unlike the female children who are encouraged to pursue art-based careers. This support eventually translates to the boy child having a high level of self-efficacy in science and thereby performing better in science subjects (Catsambis, 2005). However, since this study focused only on the parents as the factor that may influence science self-efficacy, its findings may not be assumed to be adequately addressing the purpose of the current study which focused on self-efficacy in general without necessarily just focusing on parents.

Previous researches carried out on the relationship between science self-efficacy and performances have found a relationship between these two constructs. Britner (2002, 2008); Britner and Pajare (2001, 2006); Zeldin and Pajares (2000) in their studies were able to find a significant relationship between science self-efficacy and Science performance. The studies opined that past successes and failures play a key role in determining the level of self-efficacy (Britner & Pajares, 2001). The afore-cited studies found a positive relationship between these two constructs of self-efficacy and science performance. However, these studies were carried out among college going students and therefore was beyond the scope of the current study, which was secondary school students. This therefore called for the current study.

Differences in Mathematics performance can be explained by the variations in the self-efficacy level. This position is held by many studies who find an association between the level of self-efficacy and academic achievement (Silver, Smith & Greene, 2001). Since Silver, Smith and Greene (2001) study merely focused on Mathematics alone, the study left out other science subjects that may have created a variation in the results. The current therefore went beyond this by focusing on 3 other science subjects to seek to establish the association between the level of self-efficacy and that of science performance.

Farkota (2003) study agrees with this assertion. His study established a positive correlation between student Mathematics achievement and self-efficacy Since Mustafa, Esma and Ertan (2012) studied the influence of self-efficacy and general academic performance whereas Farkota (2003) looked at self-efficacy and mathematics performance. These studies therefore failed to focus on the science subjects which was the area of interest of the current study.

Titilayo, Oloyede and Adekunie (2016) hypothesized that self-efficacy has no significant influence on the academic performance of high school chemistry students in North-central, Nigeria. This study's results indicated that the performance on chemistry examinations among high school students was quite poor. This was despite the high level of self-efficacy registered by the students. Therefore, the null hypothesis was not rejected as the results affirmed the null hypothesis. Since this study focused on general self-efficacy, the results could be as a result of the incongruency between general self-efficacy and Chemistry performance. The current study however, focused solely on science self-efficacy and science performance. Consequently, this study focused on Chemistry alone and left out other science subjects which may have led to variation of the results.

Yazachew (2013) studied the existence of an association between the students' level of self-efficacy and their Chemistry achievement among Ethiopian students. The result indicated a significant association between the level of achievement and that of self-efficacy. Consequently, from qualitative data he collected, female students stated that their confidence level greatly affected their Chemistry performance. This study investigated relationship between general self-efficacy and chemistry performance using general self-efficacy scale which may not be similar to science self-efficacy. However, the current study was more specific to establishing influence of science self-efficacy on the Science performance using science self-efficacy scale. Consequently, Yazachew (2013) study focused on Chemistry alone, the current study went beyond this to look at the other 3 sciences as well.

Aurah (2017) study established an existence of a significant relationship existing between science self-efficacy and academic performance in Science. The study established a significant relation between science self-efficacy belief and academic performance. Higher levels of science self-efficacy belief of the high school students translated to higher levels of academic performance and vice versa. Students who showed high levels of self-efficacy elicited good performance in academics. Students who showed high levels of self-efficacy in genetics were able to post good performance in genetics and vice versa. Since this study focused on Biology alone, its findings left out other science subjects which could produce a different result as each subject is unique in its own way. The current study however focused on 3 other Sciences to try and establish the relationship between them and self-efficacy.

2.4 Influence of Interest on Science Performance

Generally, studies have shown that if a student has an interest in a particular subject of study, then he/she will always dedicate his/her time on that subject. This increased attention to a particular subject will always ensure good performance (Winne & Nesbit, 2010). Performance differences could as well be attributed to the notion that students show varied levels of interest. Studies have also demonstrated that there exists a gender variations in terms of level of interest. That is to say both the males and the females have their varied areas of attention. Boys seem to demonstrate a lot of interest on the scientific matters than the females (Miller, Blessing & Schwartz, 2006)

Results in a study by Miller, Blessing and Schwartz (2006) was able to demonstrate that in general female students normally find science subjects not appealing to them as compared to the boys. In the study, the levels of students who wanted to major in the science subjects was worked out. The results indicated that fewer girls than boys chose to major in the science-oriented courses. This study however failed to ascertain whether this relationship was significant or not (Winne & Nesbit, 2010). Whereas Winne and Nesbit (2010) and Miller, Blessing and Schwartz (2006) conducted their study among college going students who had majored in science, the current study focused on secondary school students. The results of these studies could therefore not be fully relied on as they were based on a different cohort. The current study went further to use ANOVA and coefficient statistics to ascertain the presence of a significant relationship.

Role model has a great influence on the level of interest of an individual. The weak performance in science may be a result of the lack of female role models to inspire interest in science field (Belkin, 2008). Studies have shown that role models can have a positive influence on science performance; for example, Wood (2000) found that girls participation increased substantially by exposing girls to female role models and permitting them to have a brief start in nurturing in an all-female environment. Gilmartin et al. (2007) in their study found that middle and high school girls seem to especially benefit from same-sex role models in science careers. Belkin (2008): Wood (2000) and Gilmartin et al. (2007) studies however focused on girls alone. This left out the boys who were part of the current study's cohort. As such the study creates a gap which the current study sought to fill.

Consequently, media plays a key role in creating interest in science. Blickenstaff (2005) on his study on the influence of media on science performance had students reporting that rarely are women portrayed as scientists in the media or textbooks hence they lose interest in science as they perceive it as a male field. The study found that media has a negative influence on female students' science performance as opposed to male students who got the right motivation from the ideal male scientist portrayed in the media. He reckoned that media is a significant source of models for the today‘s female youth as it can affect their self-efficacy and interest through vicarious experiences. This study focused on media alone as the source of interest, which could inadequately address science performance as interest is created by several factors and not media alone. The current study went beyond this to look at interest in general and how it impacts on science performance.

Unfortunately, female scientists portrayed in the media are rarely shown as knowledgeable experts; rather, they are usually the assistant to a man who is the expert. As a result, they are made to believe that science is a male field and therefore they lose interest in it thereby leading to their weak performance. This is contrary to male students who are motivated to perform well upon seeing male scientists excelling in the media (Barnett & Rivers, 2004). According to Brownlow et al. (2000) this negative attitude about women in science contributes to girls' science anxiety which in turn results in them less likely to perform well in science. However, when media does portray a positive female science role model, it can have a significant impact on girls (Baker & Leary, 2003), including encouraging their interest in science and motivating them to perform well in science. These studies were all carried out among college students. The findings can therefore not be said to be representative of the objective of the current study which sought to establish the influence of interest on science performance among secondary school students.

Zuckerman, Gagne, and Nafshi (2001) did a research on the flexibility of interest. In the research the students were given questionnaires to fill with the intention of finding out their level of commitment to their major subjects and determine how this level translates to performance and retention of subjects. The study found that those students who displayed lack of interest were more likely to perform poorly and to change their majors than those who showed more interest in their subjects. This study concluded that interest in a particular subject influences the performance in that subject and eventual retention of that subject as a major (Zuckerman, Gagne & Nafshi, 2001). Since the study was carried out among college students the findings may not reflect the true situation in the secondary school level due to the different academic environments. It is this gap that the current study sought to fill.

Consequently, studies have also shown that teachers are quite instrumental in creating students' interest in science. Dentith (2008) asserts that the teacher as a role model to a student plays a very key role in the performance of a student in the sciences since they can create or destroy interest. For girls choosing to study science, the teacher is very important – the teacher‘s ability to teach, the support provided by the teacher, and the teacher‘s approachability play a very key role in students' science performance (Dentith, 2008; Rosser, 2004).

For most students, teacher's ability to teach and the gender are more important in students' performance (Francis et al., 2008). This is evident in Warrington and Younger (2000) study where girls specifically said that they were put off physics and chemistry because there were no female teachers in those subjects. Since Dentith (2008); Rosser (2004) and Warrington and Younger (2000) looked at the teacher as the only source of interest in science, their findings leave out other possible factors that influence interest in science. The current study therefore sought to fill this gap by looking at interest in general.

Parental role in creating interest in science cannot be overlooked as well. Scott and Mallinckrodt (2005) in a study on the parental influence on children's Science performance found that fathers have a more significant impact on children's science performance than mothers since they have a lot of influence in interest in science. This they reckon is as a result of the fact that fathers are seen as career role models. They supported their findings by alluding that female scientists on their journeys to becoming women in science discovered that they too viewed their fathers as their main connection to science. These female scientists were motivated by their fathers' role in the field of science and therefore worked hard to be like them (Mueller, 2004). Scott and Mallinckrodt (2005) and Mueller (2004) found a relationship between science performance and gender of a parent. Since these studies focused on college going students, they failed to address the scope of the current study, which is secondary school students. This is the gap that this study sought to fill.

Many a study have shown that there is a connection between student's learning and interest. [Trumper, 2006: Elster, 2007 & Logan & Skamp, 2008). Adekunle and Femi-Adeoye (2016) in a study in Nigeria hypothesized that no significant relationship exists between the student's level of interest and their subsequent academic performance in the subject of Biology. This study actually established the presence of a significant link between a student's level of interest in Biology subject and achievement in the performance. The null hypothesis was thus rejected. Since this study focused on Biology alone, it left out other science subjects which therefore calls for a study on other science subjects to ascertain the availability of a relationship in the other 3 sciences as well. The current study therefore sought to evaluate the link between interest in science and scores obtained in the four science subjects.

A research in Westlands, Nairobi by Rautta (2013) indicate that boys perform better than girls in science subjects. The study alludes this gender disparity to interest. The study opined that boys have a lot of interest in science subjects as they were associated with men therefore dedicated a lot of their time to the subjects. Girls however seemed to have interest in Biology than boys. Though this study revealed a link between interest and sciences, the study was carried out in one particular cosmopolitan region which could lack diversity for generalization to other diverse regions. It is for this that the current study was carried out in the entire county of Migori with diverse cultural differences to establish the relationship between interest and science performance.

2.5 Gender as a Moderator of the Influence of Gender Stereotype, Self-Efficacy and Interest on Science Performance

Studies have looked at how gender moderates on the influence of each of the individual three variables of gender stereotype, self-efficacy and interest on science performance as follows:

2.5.1 Gender as a Moderator of the Influence of Gender Stereotype on Science Performance

A study by Stake (2003) was able to establish that the male students had negative attitude towards the female students in science. Although the learners involved in this research were all science-oriented students, it was quite appalling that that such kind of views existed. This negative attitude was shown to negatively impact on the science performance. While it was clear that both the gender believed that women were pillars in the field of science, it was appalling that boys held the belief that few of them should be in the field of science. The more the boys and girls held onto these beliefs the worse their performance became. This study established that gender stereotype influences the science performance among science students but there was no significant deviations in terms of gender. The study sampled college students who were science oriented and therefore their result may not reflect the feelings of secondary school students. The current study therefore aimed at filling this knowledge gap by focusing on secondary school students who take all the science subjects to determine the plausibility of the assumption of this study.

Chimombo (2000) in a study in Malawi observes that negative cultural beliefs that depict the girl child as a lesser individual without abilities required in a classroom setup, are to actually blame for the poor female academic performance. This study established that gender actually influences the link between gender stereotype and performance in academics. In attempting to determine the effect of social and economic factors among students in Malawi, this study was able to conclude that lack of facilities suitable for the girl child makes it difficult for the girls to be settled in school and thus the poor performance These barriers particularly affect the girl child and as such they find it difficult to cope and concentrate in school. By the end of the day the study posits that the girl-child ends up having a weaker performance than the males. However, this study looked at academic performance in general and only focused on the girl-child which deviates from the scope of the current study which focuses on both the gender and performance in science. This therefore necessitated the current study.

In a study by Ochwa-Echel (2011) on the influence of the gender stereotype beliefs on the computer science in Uganda. The study centered on how the society discourages the girls from taking computer science. In the study, the questionnaires asked on whether the girls received any discouragement from taking this particular course. The results showed that majority of the girls received discouragement that computer science was for men and not women. Majority of the girls also reported that they received discouragement that the course was very difficult.

The result by Ochwa-Echel (2011) therefore affirms that the discouragement received from the society was gender biased against women. The study established an impact of gender on the linkage between gender stereotype and performance of computer science among males. The contrary was observed for female students. This study lay focus on the performance of computer science. However, the current study focused on performance of sciences (Mathematics, Biology, Chemistry and Physics). Its findings may therefore not adequately address the objective of this current study thereby necessitating the current study.

In the Kenyan society and indeed most of the African nations, it is a normal phenomenon to have children assist in the domestic chores. Chepchieng and Kiboss (2004) studied the influence of this on performance of academics. Their study set to determine the impact of gender and family economic status on students' performance in exams in Baringo district. The study established that the girls suffered from inadequate study times as opposed to the boys who had all the time for study. This was necessitated by the fact that the girls were given a lot of domestic chores to carry out as the boys were left to conduct their studies as academic work was considered a preserve of the male gender. This eventually reflected itself in the performance with the girls ending up performing poorly due to lack of reading. It is such disadvantages leveled against girls by retrogressive gender stereotype beliefs that result to weak girl achievement in academics in comparison to the boys.

Chepchieng and Kiboss (2004) study asserted that gender is key in influencing the linkage between gender stereotype and academic performance. However, this study looked at academic performance in general. The findings therefore may not relevantly address the current study which focuses on science performance alone. This study therefore sought to fill this knowledge gap.

2.5.2 Gender as a Moderator of the Influence of Self-Efficacy on Science Performance

Perceptions held by males and females on their abilities to succeed is quite varied. Whereas the males believe they have the ability to successfully perform scientific tasks, their female counterparts hold very low confidence on their abilities to perform such tasks. Consequently, males and females generally view their future performance in academics differently with males having a strong belief that they can achieve higher scores in Mathematics and science as opposed to the females (Rayburn, 2009).

Therefore, the connectedness between self-efficacy and future science and mathematics performance is greatly influenced by the gender of an individual (Rayburn, 2009). This study was conducted among college students and therefore focused on a different cohort. The findings may not therefore adequately address the current cohort of secondary school students due to variations in learning environments. This therefore necessitated the current study among secondary school students in Migori county.

Mohammed and Zahra (2016) studied the path between self-efficacy and performance and identified exam anxiety as a main factor in this relationship. The study further set out to determine the moderation of gender in this relationship. The study found that the females displayed high level of exam anxiety which negatively impacted on their level of self-efficacy and hence weaker performance Akbaryboorang (2009) found similar results. The result of his study showed that the female gender had actually accepted the anxiety trait as part of them and therefore they accepted the anxiety feeling which in the long run reduced their state of self-efficacy efficacy and as a result performed poorer than boys who viewed anxiety as a feminine trait.

As a result, the male students deal with their anxiety and hence a feeling of self-efficacy grows. Mohammed and Zahra (2016) and Akbaryboorang (2009) studies introduced a third variable of anxiety in their study. As a result, their finding could be affected by the effect of the 3rd variable introduced to the study. This therefore necessitated the current study to establish the link between these 2 constructs of self-efficacy and science performance alone.

Studies have shown a better male performance in science achievement tests than the females. However, these gender differences are just on particular aspects of science subjects. Generally, both the gender perform more or less equally in basic mathematics knowledge. Actually, females have displayed better computational skills whereas the males have great confidence and ability to do well in mathematics skills. The fact that the adolescents mainly display poor mathematical reasoning skills leads to several severe educational implications. Since Mathematical skills is key in the performance of the subject, we therefore have boys posting a better performance than the girls (Casey, 2003).

Casey (2003) study concluded that gender influences the relationship between self-efficacy and mathematical achievement. Since Casey (2003) study merely focused on Mathematics alone, their study left out other science subjects that may have created a variation in the results. The current therefore went beyond this by focusing on 3 other science subjects to seek to establish the moderation of gender in the relationship existing between self-efficacy and performance in science.

Consequently, Ochwa-Echel (2011) study went further and noted a major difference on the amount of confidence in Computer science in terms of gender. The study opined that this could be responsible for the variations in the performance between the males and the females. However, no significant difference in terms of gender was shown after joining the programme. The result of the study suggests that computer science programme increased the level of confidence for both the males and the females. This study focused on college students pursuing computer science. The current study however focused on secondary school students taking all science subjects and therefore these findings may not adequately address the scope of the current study.

Aurah (2017) study among the Kenyan secondary school students established that gender significantly influences academic achievement and science self-efficacy. The study established that male students had higher self-efficacy influence on achievement than the females. Since this study focused on Biology alone, its findings left out other science subjects which could produce a different result as each subject is unique in its own way. The study at hand therefore centered on the other 3 Sciences as well to try and establish the moderation of gender on the link existing between self-efficacy and science performance.

Consequently, Ochieng (2015) was able to reveal a significant relation between performance in the Mathematics subject and self-efficacy. The study further showed that the relationship was positive for the male gender but negative for the female gender. The findings of this study left out other science subjects and focused on Mathematics alone. The current study went beyond this by determine the effect of gender as a moderator in the link between self-efficacy and all the science subjects.

2.5.3 Gender as a Moderator of the Influence of Interest on Science Performance

Studies have shown that males show greater interest in science and technology issues more than the females. This stems from the fact that males are more adventurous and risk taking than their female counterparts (Venkatesh & Morris, 2000). Research has it that males are more captivated in accomplishing tasks in complex and difficult aspects as this gives them a great sense of satisfaction. Females on the other end are captivated by ease of use. (Venkatesh & Morris, 2000). Consequently, research has shown that women are more attracted to less tasking aspects of the IT curriculum while males go for the challenging ones (Terzis & Economides, 2011).

As a result of these differences in interest between the males and females, males reported better performance than females in their studies. Though Venkatesh and Morris (2000) and Terzis and Economides (2011) studies indicate a gender difference in the relationship between interest and science performance, the studies are carried out among college students thereby calling for need for this study to be carried out among secondary school students, which the current study sought to do.

These findings are supported by Hidi and Renninger (2006) study which was conducted among boys and girls who did a Science and Mathematics contest. In the study both the boys and girls would be subjected to similar contest then upon completing the contest, they would be asked to select their future area of completion. The results of the study revealed that girls selected social science as their future area of learning whereas boys chose investigative science. This clearly brought out the gender variability in the performance in science based on the level of interest. This study used longitudinal research design to obtain it’s data and therefore the findings of this study could be subject to the long period of data collection. Whereas this study used longitudinal design to collect its data, the current study deviated from this by using correlation design to determine the relationship among gender, interest and science performance.

Whereas the current studies conceptual frame work postulates that the external factor of gender stereotype interacts with the internal factors of self-efficacy and interest to produce the learning outcome, which in the current study, is science performance, all the studies above have failed to explore the applicability of this model. Studies above have looked at a single influence between the factors of gender stereotype, self-efficacy and interest on science performance without attempting to study a model which has the 3 variables influencing the science performance at one go. With limited evidence of a study exploring this model, the current study therefore aimed at filling this gap by studying the applicability of this model in the local environment. The study went further to evaluate the moderation of gender on this model.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter described research procedures beginning with: Research design, area of study, study population, sample size and sampling techniques, research instruments, reliability and validity of the instruments, data collection procedures, methods of data analysis, and ethical considerations.

3.2 Research Design

The study adopted a mixed model research design which includes both quantitative and qualitative components so as to best describe the components in the study. Based on Creswell (2012) a mixed research model design is, "An approach of inquiry involving collecting both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical frameworks. The core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone." The mixed method was chosen since it has an ability of taking data on both qualitative and quantitative designs so as to minimize on limitations of both approaches.

Specifically, the convergent parallel mixed method approach was used. According to Creswell (2013), "The convergent parallel mixed method approach involves a researcher collecting both quantitative and qualitative data, analyzing them separately, and then comparing the results to see if the findings confirm or disconfirm each other. The key assumption of this approach is that both qualitative and quantitative data provide different types of information—often detailed views of participants qualitatively and scores on instruments quantitatively—and together they yield results that should be the same."

The designs embraced here are the Descriptive Survey design and the Correlational design. In particular, the cross-sectional study of the descriptive survey design was employed here using questionnaires for data collection at one point in time. The study adopted both descriptive survey design and correlation designs to complement each other, because while Descriptive Survey does not assess relationship among variables, correlational design allows testing of relationships between and among variables and can assess the relationships (Stangor, 2011).

Orodho (2011) states that descriptive survey design is designed in preliminary and exploratory studies to allow researchers to gather information, summarize, present and interpret for the purpose of clarification. Hence the design is used where variables that exist have already occurred with non-intervention of the researcher. Descriptive Survey design was used in this study to collect data from students through questionnaires, interview schedules and focus group discussion guides and provide numeric and verbal descriptions of the 4 study variables.

Correlation design was employed to determine the kind of relation that exists between the variables of the study. This design was adopted in this study since we once we get the level of relationship between the independent and the dependent variable, we could be able to give a prediction of the level of science performance from the level of relationship obtained. The study would therefore be able to predict performance of sciences across gender based on the level of gender stereotype, self-efficacy or interest. The current study used correlational design to describe the degree of relationships in objectives1,2,3 & 4.

3.3 Area of Study

This study was conducted in the county of Migori, Kenya. Migori County is located in the Southern region of Kenya. The counties of Kisii and Narok boarders it to the East, Homa-Bay County borders it to the North, Tanzanian Republic to the South and Lake Victoria to the West. The county covers an area of 2,596.5Km^2. It lies between 1,140M and 4,625M above the sea level. It is made up of 8 Sub Counties and 8 Constituencies.

The county receives an annual average rainfall of 1250mm and an annual average temperature of 27.5^{0}C. Migori county is cosmopolitan with 2 predominant ethnic communities of Luo and Kuria. The other tribes include the Suba, Luhya, Kisii, and Somalis. It had a population of 917,170 and an average density of 353 persons per square Kilometer with Migori Sub County having the highest population density of 574 people per Km^2 . “Migori County is a child rich population, where 0-14 years’ old constitute 50% of the total population. This is due to high fertility rates among women as shown by the highest percentage household size of 4-6 numbers at 41%” (Kenya Population and Housing Census, 2009).

The main economic activity of the county is agriculture. Major crops grown under this sector include; sugar cane tobacco, maize, beans, finger millet, sweet potatoes and horticulture. Fishing is another major economic activity which is mainly practiced in Nyatike Sub County along Lake Victoria. Mining is practiced in small scale at Macalder in Nyatike Sub County while sand harvesting is also practiced in Kuria West and Nyatike Sub Counties. Dairy farming is mainly practiced in Rongo and Uriri Sub Counties.

According to Kenya Population and Housing Census (2009), “Only 5% of residents in Migori County use electricity as their main source of lighting. A further 26% use lanterns, and 66% use tin lamps. 1% use fuel wood. The total length of all classified roads in the county is 910 Km with bitumen surface covering 112 Km, gravel surface 324 Km and earth surface 514 Km. The population below poverty line is 46.7%. In Migori County, 9% of the residents with no formal education, 9% of those with a primary education and 22% of those with a secondary level of education or above are working for pay. Work for pay is highest in Nairobi at 49% and this is twice the level in Migori for those with secondary level of education or above."

Consequently, the Kenya Population and Housing Census (2009) notes that, "Only 15% of Migori County residents have secondary level of education or above. Rongo constituency has the highest share of residents with a secondary level of education or above at 19%. This is 7 percentage points above Kuria East constituency, which has the lowest share of residents with a secondary level of education or above. Rongo constituency is 4 percentage points above the county average. A total of 65% of Migori County residents have a primary level of education only.

Uriri constituency has the highest share of residents with a primary level of education only at 68%. This is 5 percentage points above Kuria West constituency, which has the lowest share of residents with a primary level of education only. Uriri constituency is 3 percentage points above the county average. Some 20% of Migori County residents have no formal education. Kuria East constituency has the highest share of residents with no formal education at 24%. This is 6 percentage points above Rongo constituency, which has the lowest share of residents with no formal education. Kuria East constituency is 4 percentage points above the county average."

A summary of the disadvantaged position of Migori county in relation to the national statistics is presented in the table below:

Table 3.1: Summary of Status of Migori County in Relation to the National Status

Category	**Migori County Rating**	**National Rating**
Formal Employment	13%	49%
Secondary level of Education and above	15%	45%
Enrolment in all sciences in 2019 KCSE	10.22% F 20.46M	22.40F 30.14M

From the table it is evident that those in formal employment in Migori county is 13% in comparison with the national figure of 49%. This lack of formal employment in the county makes Migori county stand at a disadvantaged position as students lack exposure to appropriate role models in the STEM fields to help demystify the negative societal beliefs that discriminate against women in the STEM field. As such the students' level of self-efficacy and interest in science is likely to be lower. Consequently, the low level of those with beyond secondary level of education of 15% against the national standing of 45%, acts a breeding ground for negative gender stereotype beliefs in Migori county.

From the table it is evident that just 10. 22% of girls in comparison with 20.46% of boys who sat for 2019 KCSE examination did all the 4 science subjects. This presents a huge gap in in terms of gender in the enrolment in sciences. This percentage of female science enrolment is even lower when compared with the national enrolment ratio of 22.40% of girls against 30.14% of boys. Migori county as such risks having fewer number of females enrolling for STEM courses at the post-secondary level colleges since Physics subject which was the most avoided is a key requirement for enrolment in some STEM courses. Consequently, the KCSE performance of the year 2019 puts Migori county at a disadvantaged position in comparison with the neighbouring counties and the entire country. This is as indicated below:

Table 3.2: Gender Disparity in Science Performance in Migori County in Comparison with the Neighbouring Counties

Aspect	Migori county	Homa-Bay county	Kisii county	National
Gender disparity in science performance in the 2019 KCSE	4.02	3.86	3.77	2.80

From the table it is evident that Migori county has the highest gender disparity in science performance in comparison with its neighbours and nationally. This calls for an investigation locally to try and address this negative performance in Migori county. It is for this reason and the afore-cited reasons that the current study was carried out in the county of Migori.

3.4 Study Population

The study's population was made up of form four students of the year 2020 and the Heads of Science Department in Migori county. The form four students in this target population were those who took all the 4 science subjects of Mathematics, Biology, Chemistry and Physics. Their total population was approximately 2,200, i.e. 1550 boys and 650 girls spread out in the 240 public secondary schools in the county (Migori County Director of Education Office Records, 2019). The population of the heads of science department was approximately 240 since the 240 public secondary schools were believed to have one HOSD each. The HOSD were selected since they have a better understanding of the performance of the 4 science subjects.

3.5 Sample Size and Sampling Technique

According to Fisher et al. (1991) where the population of the study does not exceed 10,000, sample size is calculated by the formula:

$$n_f = \frac{n}{1+\left(\frac{n}{N}\right)}$$

Where-:

n_f: is the sample size

N: is the estimated population size

n: is the desired sample size when the study population is less than 10 000 and to get n we use the following formula:

$$n = \frac{Z^2pq}{d^2}$$

Where-:

n - The desired sample size

z - The standard normal deviation, set at 1.96, which corresponds to 95% confidence l level

p- The proposition in the target population estimated to have particular characteristics. If there is no reasonable estimate, then we use 0.05

q = 1.0 – p

d = the degree of accuracy desired, here set at 0.05 corresponding to the 1.96.

In substitution, $n = \frac{1.96^2 \times 0.5 \times (1-0.5)}{0.05^2}$ = **384**

Therefore, to get the sample size the researcher used the initial formula:

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

In substitution;

$$n_f = \frac{384}{1+\left(\frac{384}{2200}\right)} = \mathbf{327}$$

The sample size was therefore set at 327

The study used Stratified sampling method, Purposive Sampling and simple random sampling technique to sample the students for study. This study used Stratified sampling technique because in statistical surveys, when sub-population within an overall population vary, it is advantageous to sample each sub-population (stratum) independently (Kothari, 2014).

This was done by categorizing the groups into homogeneous sub-groups of national, extra-county, county and sub-county schools. Purposive sampling was used to select single gender schools to ensure balanced gender representation whereas simple random sampling was used for selection of students and schools. The number of schools in each category is presented in Table 3.3 below:

Table 3.3: Number of Schools in each Stratum in Migori County

Stratum	Number of Schools	Percentage
National	2	1
Extra County	8	3
County	14	6
Sub-County	216	90
Total	**240**	**100**

Consequently, to achieve gender representation, Purposive sampling was used to select one girls' national school, one boys' extra county school and one girls' county school. To get the number of students to be sampled from each stratum, a proportion was worked out using the following formula:

$$N=\frac{\text{Number of schools in a particular stratum}}{\text{Total number of schools}} \text{ x Sample size}$$

Where N is the number of students in each stratum.

From this formula, the researcher came up with the following sample plan in Table 3.4 indicating numbers of students that were sampled from each stratum.

Table 3.4: Numbers of Students Sampled from each Stratum

Cluster	Gender		Total
	Male	**Female**	
National	0	3	3
Extra County	11	0	11
County	0	19	19
Sub-County	189	105	294
Total	**200**	**127**	**327**

In getting the names of students to be sampled, the names of students from each stratum were written in different sheets of papers then placed in different urns depending on the stratum and well mixed respectively. Names were then picked randomly with replacement noting all the names

Creswell (2014) notes that, "Unquestionably, the sample for the qualitative data collection should be smaller than that for the quantitative data collection since the intent of data collection for qualitative data is to locate and obtain information from a small sample size but to gather extensive information from this sample; whereas, in quantitative research, a large *N* is needed in order to conduct meaningful statistical tests. A focus group interview for instance should contain between 6 to 8 participants." For this reason, the size of the focus groups for the current study was set at 6 participants each. These participants were picked from those who took part in answering the questionnaires as typically there is room for comparing the similarity in the two data sets.

A total of 10 groups comprising of 6 participants each were used in the study. County, extra-county and national schools each had 1 group while the remaining 7 groups came from the sub-county schools. Names of 6 students from the county and extra county schools were randomly selected to take part in the FGD while all the 3 students from the national school were used to form a group since it already forms a saturated sample.

To get the groups from the sub-county category, 7 schools (with more than 6 respondents) were randomly selected from the sub-county schools that took part in the study and then 6 participants from each of these randomly sampled schools were randomly selected to take part in the FGD. Thirty heads of science department from 30 schools that were used in the study took part in answering the interview schedule since their information was key in providing qualitative back up for the quantitative data obtained from their students.

3.6 Research Instruments

The researcher employed both qualitative and quantitative data collection techniques by administering questionnaires, interview schedules and FGDG to students. The instruments used were: Gender Stereotype Scale, Science Self-Efficacy Scale, Science Interest Survey, Focus Group Discussion Guide, Science Achievement Test and Head of Science Interview Schedule. The instruments are described below:

3.6.1 Gender Stereotype Scale (GSS)

Gender stereotype Scale is a scale used to measure the level of gender stereotype surrounding science. It is a modification of Kerr and Holden (1996) Gender Role Belief Scale (GRBS). The scale was modified to remove the aspects of culture that are foreign to the local environment. The scale has a total of 9 items that require the respondent to state to what extent they agreed with the stereotype comments given. The items were answered on a 4-point Likert type scale ranging from strongly disagree (very low level) = 1, disagree (moderately low) =2, agree (moderately high) to strongly agree (very high level) = 4. Previous reliability test on the original instrument has yielded Cronbach' Alpha Reliability Coefficient of .89 (Kerr & Holden, 1996; Morrison & Parriag, 1993; Neirman, Thompson, Bryan & Mahaffey, 2007). However, the scale was taken through a reliability and validity test to ascertain its fitness in the current study. Sample items include:

1. Sciences are for men whereas Arts are for women.
2. Women cannot perform well in sciences even if they try as hard as possible.

(see APPENDIX C).

3.6.2 Science Self-Efficacy Scale (SSES)

This Scale measured the level of science self-efficacy. The scale is an adaptation from Capa Aydin and Uzuntiryaki (2009), "High School Chemistry Self-Efficacy Scale." A modification was done to the scale to capture science in general rather than just focus on Chemistry which was the case with the original scale. The scale has 12 items scored in a 4-point Likert-type scale that range from; no confidence at all (lowest level) = 1, Very little confidence (moderately low level) = 2, Much confidence (moderately high level) = 3 to complete confidence (very high level) = 4. The original instrument gave a reliability of .90 (Uzuntiryaki, Capa Aydin, Ceylandag & Cömert, 2011). The current scale was subjected to reliability tests to ascertain its suitability in the local environment. Item sample include:

1. How much confidence do you have that you could explain Scientific terms?
2. How much confidence do you have that you could choose an appropriate formula to solve a scientific problem?

(see APPENDIX D).

3.6.3 Science Interest Survey (SIS)

The SIS measured the level of interest a student had in in science. This survey is a modification of Hidi and Renninger's (2006) Science Interest Survey. The initial scale was modified to remove the content of curriculum that were foreign to the Kenyan curriculum. The survey has 8 items answered on a 4-point Likert type scale that range from strongly disagree (very low level) = 1, disagree (moderately low) =2, agree (moderately high) to strongly agree (very high level) = 4. Previous research has yielded reliability estimates of .85 (Hidi & Renninger's, 2006). The current scale was subjected to reliability tests to ascertain its suitability in the local environment. Sample items include:

1. Science subjects are interesting
2. Learning sciences is important.

(see APPENDIX E).

3.6.4 Science Achievement Test (SAT)

The researcher used the SAT to measure the performance of sciences. The researcher developed the test from the KCSE examination of 2012 and picked questions drawn from the forms 1 and 2 syllabi. The test was made up of 4 subjects; Physics, Biology Chemistry and Mathematics with each subject having a total of 25 marks. The items in the scale fell under 4 sub-scales of Physics, Biology Chemistry and Mathematics. The scoring for the scale was keyed in as the total score attained for the individual sub-scales therein. Total score got from the 4 sub-scales was 100 marks with scores below 50 marks being weak performance while scores above 50 marks being good performance. The scale was subjected to a pilot study to ascertain its reliability before being adopted for use in the main study. Educational Psychology experts from the department of Educational Psychology, Maseno university advised on the face and content validity of the instrument. Sample items include:

1. A solid weighs 16.5 N on the surface of the moon. The force of gravity on the moon is 1.7 Nkg^{-1}. Determine the mass of the solid.
2. State two reasons why hydrogen.is not commonly used as a fuel.
3. Expand and simplify the expression $(2x^2 – 3y^2)2 + 12x^2y^3$
4. How does nutrition as a characteristic of living organisms differ in plants and animals?

(see APPENDIX F).

3.6.5 Focus Group Discussion Guide (FGDG)

The FDGD was used to get more information from the students on the study's variables and was meant to give more insight to the quantitative data got from the questionnaires. The discussion served to complement the quantitative data and also provide peripheral information that may have not been covered by the study questionnaires. Focus Group Discussion Guide was used due to its ability to give a more detailed and in-depth insight of the issues provided. Consequently, it allows for integration of the qualitative and the quantitative data (Creswell, 2013). This instrument was administered to a total of 10 groups from 10 randomly sampled schools. The groups were made up of 6 students each who had completed the questionnaires. The scale was subjected to content validity tests to remove the irrelevant or redundant content (see APPENDIX G).

3.6.6 Head of Science Interview Schedule (HOSIS)

The Head of Science Interview Schedule was used to get qualitative information on the performance of science across gender from the teachers' point of view. The schedule is made up of 5 open ended questions which sought to find out the factors responsible for gender disparity in science performance. The instrument was administered to the 30 heads of science department in Migori county whose schools took part in the study. Educational Psychology experts from the department of Educational Psychology, Maseno university advised on the face and content validity of the instrument (see APPENDIX H).

3.7 Reliability and Validity of the Instruments

In order to ascertain the instrument's extent of reliability and validity in Migori county setting, the instruments were subjected to a pilot study to pre-test them. The schools which took part in the pilot study were those not captured in the study sample using different students who were not captured in the sampled population in order to prevent pre-exposure to the study instruments which could interfere with findings of the study. 10% of the study sample of 327 took part in the pilot study (Connelly, 2008) that formulated a sub-sample of 33 participants.

3.7.1 Reliability of Instruments

Reliability refers to how consistent a research procedure or instrument is. It therefore means the degree of consistency demonstrated in a study (Amin, 2005). The reliability of the instruments for data collection was measured by making assessment of scale's internal consistency; the degree to which the item that make up the scale 'hang together' was investigated. The study used the test-re-test technique to ascertain the instrument's reliability by administering a similar questionnaire twice within a time gap of 2 weeks to a particular group of respondents. The means for both the first and the second tests are then worked out. The Pearson Product Moment correlation coefficient

(r) was then worked out for the means of the two tests. A Test-re-test was conducted on the different instruments using a sample of 33 participants and yielded the following results.

Table 3.5: Cronbach's Alpha for Each Variable

Variables	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items
Science Performance	0.782	0.781
Gender Stereotype	0.792	0.795
Self-Efficacy	0.769	0.768
Interest	0.780	0.783

Tables 3.5 shows the reliability measurement for each variable, with Cronbach's Alpha and Cronbach's Alpha based on standardized items. The α Coefficients are between 0.769 and 0.792 which are all above the standardized point of .70. Since each variable attained the set minimum standard of .70, all the instruments were deemed fit for the study.

3.7.2 Validity of the Instruments

Validity determines whether the research truly measures what it is intended to measure or how truthful the research results are. According to Amin (2005), the research instruments must be appropriate for the objectives to be achieved. Validity is categorized into 2 aspects of face and content validity. Face validity is whether the instrument "looks like" can measure what they purport to be measuring. Content validity provides the degree to which an instrument contains the right domain /content to be measured (Kombo & Tromp, 2006).

This study ensured validity by presenting the study's 4 questionnaires, heads of science department interview schedule and focus group discussion guide to the supervisors at the department of Education Psychology, Maseno University. To calculate the validity of the instruments, the Content Validity Index formula was used:

CVR = ((G-(N/2)) / (N/2))

Where:

N; Represents the total number of experts

G: Represents the number who rated the objects as being good.

The researcher involved 4 teachers pursuing Doctoral degree in Educational Psychology from Maseno university, Jaramogi Oginga Odinga University of Science and Technology and Rongo University who are specialized in Mathematics, Physics, Biology and Chemistry respectively in determining the face and content validity of the instruments and more particularly, the Science Achievement Test.

The experts were asked to rate the questionnaires as either good or bad. All the experts rated the instruments as good, hence the Content Validity Index was computed to be 1.0. For any instrument to be accepted to be valid, the average index should be 0.7and above (Amin, 2005). Given a CVR index of 1.0 the questionnaires validity were validated. The researcher finally incorporated the comments received from the experts while drafting the final copy.

3.8 Data collection Procedure

Permission for data collection was sought from the Maseno University Ethics Review Committee (MUERC) after getting approval of the proposal from the Maseno University School of Graduate Studies (SGS). MUERC then gave the authority to collect data. Consequently, an application was made to the National Commission for Science, Technology and Innovation (NACOSTI) which provided the license to conduct research. The researcher then visited the Migori County Director of Education (MCDE) to give information about the intended study.

The researcher then visited the schools sampled for the study to seek permission from the principals to conduct the study and request the principal to seek permission from the Parents Association (PA) to allow students participate in the study. The researcher then made appointment to go back for actual data collection which was done through administering of questionnaires, interview schedules and focus group discussion guide.

The administration time varied between 30 to 40 minutes each for GSS, SSES and SIS. GSS and SSES were given during the morning hours of the data collection day while SIS and FGDG were administered in the afternoon. Science Achievement Test was administered separately on the second day of data collection. and the administration time was 2 hours 30 minutes. After administering the SAT, the researcher administered the Head of Science Interview Schedule which took approximately 1 hour. The responses from the questionnaires were immediately collected and keyed into computer ready for the process of analysis. The responses from the FGDG and HOSIS were recorded and organized into emergent themes. The researcher was assisted by four trained research assistants each specialized in a particular science subject to collect the data.

3.9 Methods of Data Analysis

Data analysis is the process of inspecting, clearing, transforming and modelling data with the goal of discovering useful information, suggesting conclusions and supporting decision-making (Fraenkel & Wallen, 2012). The current study used both qualitative and quantitative data analysis methods. According to James and Busher (2009), a combination of both quantitative and qualitative methods provides a richer and more complete description covering fairly all the aspects of the phenomena under investigation. Analysis of qualitative and quantitative data was done using a side-by-side comparison.

3.9.1 Quantitative Analysis

Descriptive statistics, Qualitative analysis, Correlation analysis, Simple Linear Regression and Multiple Linear Regression Analysis were used as the data analysis methods for the study. The Statistical Package for the Social Sciences (SPSS) software was used in the analysis. Using SPSS, quantitative data obtained from closed ended questionnaires were tabulated and analyzed using Descriptive Statistics such as percentages, graphs, averages and charts. To determine the gender disparity in the levels of the 4 variables of Gender Stereotype, Self-Efficacy, Interest and Science Performance, Independent Sample T-Test (2 tailed) was conducted. Correlation analysis was performed to evaluate presence of a relationship between the study variables.

Before conducting multiple regression analysis, it is important to ensure that the data meets the set assumption standards for multiple regression analysis. Achievement of these standards ensures a valid multiple regression analysis. Consequently, establishing deviations from the set standards is very necessary for necessary modifications (Field, 2005). The current study therefore tested these assumptions based on the following recommended tests:

3.9.1.1 Assumption Testing for Multiple Regression Analysis

According to Field (2005) the assumptions are tested based on parameters of; sample size adequacy, normality of the dependent variable, independence of observation, linearity between the predictor and predicted variables, multicollinearity of the variables, normality of the residuals, homoscedasticity test of residuals and presence of outliers. The assumption testing result is as presented in APPENDIX I and as summarized in the table below:

Table 3.6: Summary of Assumptions Testing for Multiple Regression Analysis Results

	Sample Size Adequacy	**Normality of the Dependent Variable**	**Independence of Observations**	**linearity between the outcome variable and the independent variables**	**multicollinearity of the variables**	**normality of the residuals**	**homoscedasticity test of residuals**	**presence of outliers**
Result	Sample size of 327 against 3 predictors	Test of Normality for Distribution of Dependent Variable: Kolmogorov-Smirnov[a] test=.200 & Shapiro-Wilk tests=2.37. A normal Q-Q plot= all points close to central point. Detrended Normal Q-Q Plot= normal deviation above and below central line.	Durbin-Watson =1.702	Scatter plot=even spread between -3 to 3 in X & Y axes. Normal Probability Plots= values falling on or close to the central diagonal line	correlation matrix=< .08. Variance Inflation Factor= < 10. Eigenvalues values = around zero & all condition index values < 100	Normal probability plot= all dots are on a straight line & Histogram= normal distribution & the mean is also very close to 0	Scatterplot of standardized residuals against standardized predicted values= random array of dots that are evenly dispersed around zero	Standardized residual = between -2.093 to 2.732. The Cook's Distance value= minimum value of .000 and a maximum value of .230.
Criterion for Significance	Each predictor should at least contain 10-15 subjects	Kolmogorov-Smirnov[a] test & Shapiro-Wilk tests >.05.Normal Q-Q plot graph= linear relationship with all the points appearing close to the central point. Detrended Normal Q-Q Plot= normal deviation above and below central line.	Durbin-Watson = 1.5-2.5	Scatter plot=even spread between -3 to 3 in X & Y axes. Normal Probability Plots= values falling on or close to the central diagonal line	correlation matrix=< .08. Variance Inflation Factor= < 10. Eigenvalues values = around zero & all condition index values < 100	Normal probability plot= all dots are on a straight line & Histogram= normal distribution & the mean is also very close to 0	Scatterplot of standardized residuals against standardized predicted values. The graph should show a random array of dots that are evenly dispersed around zero	Standardized residual= accepted range of -3 to 3. The Cook's Distance value < 1.00.
Outcome	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant

The data for the current study therefore meets all the 8 set assumptions for multiple regression analysis. The researcher therefore proceeded to do multiple regression analysis.

3.9.1.2 Simple Linear Regression Analysis

Simple Linear Regression Analysis was then performed to establish the degree of prediction of the individual independent variables on the dependent variable. In a nut shell, simple regression analysis was done to ascertain the relationships in the first 3 objectives between the study's 3 independent variables (Gender Stereotype, Self-Efficacy and Interest) and the dependent variables (Science Performance).

To ascertain the significance of the regression model between the individual IV and the DV, ANOVA statistics was used. To test hypothesis 1- 3, hypothesis testing was done using coefficient statistics in simple regression analysis. Hypothesis testing involves assessing the significance of individual independent variable's influence on the dependent variable at a p-value <.05.

3.9.1.3 Multiple Regression Analysis

Since the current data met the requirements of MLA, Multiple regression was then done to determine the overall fit of the model and to get the magnitude of the influence of the predictor variables on the predicted variable. This would help to establish which variables have the highest effect on the dependent variables.

3.9.1.4 Moderation Analysis

To test the 4^{th} hypothesis which in a nut shell is moderation analysis, the PROCESS Dialogue by Andrew F. Hayes was downloaded and installed in SPSS. What the PROCESS Dialogue does is that it centers and creates the interaction term automatically (Andrew, 2017). Therefore, each individual predictor variable was keyed in as the independent variable (X), science performance was keyed in as the dependent variable (Y) while Gender was keyed in as the moderating variable (M) in SPSS's PROCESS by Andrew F., Hayes and then run.

Simple slopes analysis was used by this study to evaluate the presence of a moderating effect. The study used the simple slopes analysis to determine moderation among the different gender by splitting the data into two variables of males and females using the values used to code them and then assessing the different levels of effect for males and females. A simple slope graph was produced to show the difference in the effect for males and females.

3.9.2 Qualitative Analysis

Qualitative data obtained from Focus Group Discussion Guide and interview schedules were analyzed using thematic analysis. According to Braun and Clarke (2006). Qualitative data analysis tends to be inductive; the analyst identifies important categories in the data as well as patterns and relationships through a process of discovery (James & Busher, 2009). The current study used thematic analysis in analyzing the data. Thematic analysis is a form of analysis of data in which emphasizes, pinpoints, examines and records data in patterns or the data (Braun & Clarke, 2006). Themes are patterns across data that are important to the description of a phenomenon and associated to a specific research question.

Thematic analysis is performed in six phases to create meaningful established patterns. The phases are: familiarization with the data, generating initial codes, searching for themes using codes, reviewing themes, defining and naming themes and producing the final report (Qualitative Research and Consultancy, 2015). The following Table 3.7 is a sample of verbatim quotes, theme/sub themes and codes used during thematic data analysis.

Table 3.7: Sample of Excerpts, Themes/Sub-Themes and Codes from Qualitative Analysis

Verbatim Reports	Themes/Sub-Themes	Codes
I generally hate sciences, they make me sick and I don't think science is a girl thing. Whenever it's time for any science subject, I just switch off completely.	Student Attitude	SASP
Teachers themselves tell us that science is not for girls. I remember our teacher telling girls who had selected Physics to leave his class as he knew they could not handle the technical content in Form 4 syllabus.	Teacher Related Factors	TRSP
My dad literally chose subjects for my brother and I then when I questioned him why he chose all sciences for my brother and gave me History, he told me that sciences are for men and girls are good in Arts.	Parental Influence	PISP

The present study adopted all the six phases of thematic analysis. Data was inscribed retaining all the original verbatim quotes of the participants while re-reading and noting all the initial ideas as was in (Raburu, 2015). Different codes were then sorted into various themes as shown in Table 3.7 while checking those themes which didn't have enough data and those that have similarities which could be merged.

3.10 Ethical Considerations

An authority to collect data was first sought from Maseno University Ethics Review Committee. The researcher then sought a permit from the National Commission for Science, Technology and Innovation (NACOSTI) which gave the license to conduct the research. After getting a letter from MUERC giving authority to conduct data collection and a license from NACOSTI to conduct research, the researcher proceeded for authorization from the County Director of Education who gave an introductory letter to be presented to the school heads to allow for data collection. After producing the MUERC and the CDE's letters, the researcher then proceeded to explain to the heads of the institution the purpose of the study.

Since some of the respondents of the study could be considered minors i.e. being below 18 years of age, the researcher sought consent from the children's parents to permit their children to take part in this study. This was done by requesting the heads of the institution to give the phone numbers of the parents of the students who would be involved in the study so as to call the parents to give permission to their children to participate in the current study. The parents were contacted and they gave their consent. The researcher then proceeded to collect the data for the study.

Before subjecting the instruments to the respondents, an informed consent/assent of the participants was sought. To do this, the participants were told in clear terms what the study entailed and its purpose. The respondents were also told of how beneficial the findings would be to them and even the researcher. The respondents were informed of the voluntary nature of their participation and that failure to take part would not attract any penalty whatsoever. The results of the findings would remain confidential as individual responses would not be known in any way since the respondents would not be required to put down their names.

A copy of consent form was provided to respondents and the researcher took them through the content of the form and they only signed for consent to participate once they felt that they were comfortable with the conditions provided (see APPENDIX A). A copy of information sheet containing all ethical considerations was also be availed to each respondent taking part in the study as it was attached to the questionnaires for them to only proceed after agreeing with the issues (see APPENDIX B). In case of any queries or complaints that may arise later, the respondents would be in a position to channel them to either the university or the researcher through the addresses given.

Data was collected using the 4 questionnaires provided to each learner. This data remained anonymous and confidential as no identification detail was put on either the questionnaires or the discussion guide except the detail in the consent form that was provided to the students. As such a secret code was given to the questionnaire that corresponds with the one on the consent form associated with it.

The questionnaires were then kept separately from the consent forms in locked cabinet files whose keys were held either by the researcher or the research assistants and no other person could be able to gain access to the copies. Once this data had been collected it was keyed into the computer and saved in various forms which were protected using a secret password. The schools which took part in the study would be provided with a report of the study's findings.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results, analysis and discussion of the data collected in the current study. Data was analyzed and discussed according to the stated objectives of: To examine the influence of gender stereotype on science performance, examine the influence of self-efficacy on science performance, examine the influence of interest on science performance and to evaluate gender as a moderator of the influence of gender stereotype, self-efficacy and interest on science performance.

The findings of this section were presented in the following sub-headings of: Demographic information, Science performance across gender, influence of gender stereotype on science performance, influence of self-efficacy on science performance, influence of interest on science performance and gender as a moderator of the influence of, gender stereotype, self-efficacy and interest on science performance.

4.2 Demographic Information

The researcher used data from 240 secondary schools in the county. From this we had 2200 students: 1550 boys and 650 girls and 240 heads of science department. From this population the samples were; 327 student respondents and 30 heads of science department respondents.

4.2.1 Students' Demographic Information

The findings of the study show that there was a remarkable disparity in terms of the number of female students and their male counterparts who participated in this study as presented in Table 4.1below:

Table 4.1: Student Respondents' Distribution by Gender

		Frequency	Valid Percentage	Cumulative Percentage
Valid	MALE	200	61.2	61.2
	FEMALE	127	38.8	100.0
	Total	327	100.0	

From the above table, it is evident that 200 boys which translates to 61.2% of students and 127 girls which translates to 38.8% of students took part in the study. This presents a gender gap of 22.4% in favor of the males implying that the number of males doing all the 4 subjects of Physics, Chemistry, Biology and Mathematics is higher than that of females. The disparity is actually attributed to the fact that fewer girls select Physics than boys. This corroborates the scenario evident in Migori County Education Office Records (2019) which stated that of all the students who sat for all the Science subjects in the 2019 KCSE, 71% were males whereas 29% were females showing gender bias in favour of the males. Consequently, these findings reflect the assertion by the UNESCO (2016) that stated that girls tend to shy away from taking the subjects of Physics and higher Mathematics at high school level due to their complexity.

4.2.2 Heads of Science Department's Demographic Information

The findings of the study showed that sub-county schools had the highest number of heads of science department in comparison with other strata. This is as presented below in Table 4.2:

Table 4.2: Heads of Science Department Distribution by Stratum

Stratum	Number of Heads of Science Department	Percentage
National	1	3.33
Extra-County	1	3.33
County	1	3.33
Sub-County	27	90
Total	30	100

From thew table above it is evident that a whopping 90% of the heads of science department came from the sub-county schools while only 10 % came from the other strata combined. This is reflective of the ratio of school strata in Migori county as we have 90% of schools belonging to the sub-county stratum (Migori County Education Office Records, 2019).

4.3 Science Performance across Gender

To provide preliminary data for the analysis of the set objectives, the level of science performance across gender was analyzed. The data gives an insight into students' performance in various science subjects which helps in bringing out disparity in performance of various subjects across gender. The following table presents the results of science performance analyzed in terms of means across gender and the overall standard deviations and means.

Table 4.3: Level of Science Performance across Gender

	Mean			
	M	**M%**	**F**	**F%**
Physics Score	9.90	39.6	7.02	28.08
Chemistry Score	7.39	29.56	5.78	23.12
Mathematics Score	11.25	45	9.08	36.32
Biology Score	10.66	42.64	8.92	35.68
Science Performance	**39.2080**		**30.8000**	
Valid N (listwise)	200		127	

Key: M= males, F= females, %= Percentage. The mean score per subject is the mean performance in a subject out of 25 while the percentage is the percentage score out of 25. Science performance is the sum of the scores of the four individual subjects.

Table 4.3 shows that the male students had a higher performance achievement than the female in all the science subjects. Physics had the highest gender disparity in performance standing at 11.52% followed by Mathematics at 8.68%. Biology had the third highest gender disparity in performance standing at 6.96% while Chemistry had the least disparity standing at 6.44%. Consequently, the average science performance for all the science subjects for males is 39.2080 in comparison to the females' score for the same of 30.8000. This gives a clear margin of 8.408% in favour of the males. To be able to determine whether there is a statistical significance in the difference in performance in science across gender, the independent samples t-test was used at α=.05 (two-tailed). Table 4.4 displays the outcome of the independent samples t-test.

Table 4.4 Test of significance for the gender difference in science performance

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	**Sig.**	***t***	***df***	**Sig. (2-tailed)**
Performance in Science	Equal variances assumed	.83	.37	3.89	325	.000
	Equal variances not assumed			4.08	100.60	.000

Table 4.4 displays the output of the analysis' result which shows that the fundamental assumption for t-test regarding the equality of variances was satisfied at α=.05 (F=.83, p=.37). With equal variances, the science performance' difference across gender was statistically significant at α=.05 (t=3.89, p=.000). Therefore, the differences in the means in the performance of science across gender was a true difference in the population from which the sample was drawn and not a result of chance or sampling error. Therefore, the study posits that the male students in Migori county perform better than female students in science subjects.

This was in line with the interview schedule's findings. The heads of science department when asked whether there is a gender disparity in science performance, all agreed that female students have been performing weaker than boys in the science subjects. One teacher who had served as head of science department for 12 years reported that:

> *Generally, for the time I have served as a head of science department, I have seen a consistent gender gap in science performance. The girls show a weaker performance in sciences that the science field appears as a preserve of the males. Although there is a slight improvement in girl performance in science, that doesn't mean that girls are now performing any better than boys in sciences, actually there still exists a significant gap in the performance and I think something should be done to improve the female student's performance in science.*

This finding mirrors that of other studies done elsewhere. For example, it is in agreement with the findings of Eriba and Sesugh (2006) in Nigeria which established a performance difference in terms of gender in integrated mathematics and science. This study showed that boys received higher achievement scores in these subjects than girls. Consequently, the finding corresponds with that of Ochwa-Echel (2011) in Uganda which revealed that the girls performed poorly than the boys in the science subjects. Since science subjects are a requirement for placement into computer science courses, the study established that fewer girls than boys were able to enroll for this course.

Likewise, the finding is a true mirror of what the situation is in Kenya. Past researches and studies have shown that performance in the STEM subjects has been a serious course of alarm. Worse still this problem is aggravated by the fact that girls perform even dismally than their male counterparts. This presents a major problem as the STEM field is not just marred by poor performance alone but it is also affected by gender imbalance against the female population (Forum for African Women Educationalists, 2008).

With the Science Achievement Test being developed from science questions in the KCSE exams, the study finding mirrors the true performance scenario on the ground as recent national KCSE results of 2017, 2018 and 2019 have all indicated that boys score highly than girls in all the sciences. For instance, the 2017 KCSE results shows that boys scored better than girls in 23 subjects, defeating girls in all Sciences, whereas girls only defeated boys in 6 subjects of; English, Kiswahili, CRE, Home Science, Art, and Design and Electricity (KNEC Report, 2019). Consequently, the 2018 KCSE exam shows that girls lagged behind the boys in all the STEM related courses, including, Chemistry, Agriculture, Computer Studies, Mathematics, Physics Electricity, Biology General Science, Power Mechanics and Aviation.

The current finding also corroborates other studies done in the local environment. According to the records at the Migori county education office, boys have continued to perform highly than girls in sciences. For instance, in the 2018 KCSE results, Migori county had girls scoring an average mark for all sciences of 22.63% against the boys' 26.65%, giving a gender disparity of 4.02%. Similarly, the finding is in correspondence with the results of Migori county KCSE exams performance where just 10. 22% of girls in comparison with 20.46% of boys who sat for that examination did Physics giving a gender disparity of 10.24% (Migori County Education Office Records, 2019).

Oral face to face discussion during focus group discussion also corroborated this finding. All the students who participated in the FGDG when asked which science subject has the highest disparity in performance in terms of gender, were in agreement that Physics was better performed by boys than girls unlike other science subjects where participants gave conflicting opinions. For example, one participant responded that:

> *The answer is definitely, Physics. Boys by far perform better than the girls in Physics and the subject is actually considered a male subject. Even the number of girls who select Physics is so low in comparison with the boys. But above all, all the science subjects show a remarkable difference in science performance with boys topping the girls in these subjects.*

These assertions are congruent with other reports that have found that among the science subjects, Physics is the most gender stereotyped science subject with the belief that it a male subject. Subsequently it has the highest performance gap in terms of gender due to such negative beliefs (Carlone, 2003). Similarly, the finding is similar to the assertions of Kashu (2014) that in Kenya fewer number of number of girls would choose to study Physics since most girls lack self-efficacy to perform in it. They doubt their capability to excel in this field as it is considered too difficult for girls. These negative beliefs are supported by peers, parents, society and even the teachers who also hold such beliefs. This reflects itself in poor female performance in such areas regarded as a preserve of the males.

However, the current findings contradict that of Omoniyi (2006) study which reported otherwise. The study reported that males were beginning to perform poorly in science and were losing interest in the field. The study posited that girls were gaining ground in sciences and would soon lead the boys in the science careers. However, the result of his study was based on qualitative reports from respondents and not on actual performance and therefore the finding cannot be statistically authenticated as students tend to exalt themselves to appear favourable before the interviewer.

4.4 Influence of Gender Stereotype on Science Performance

To test the influence of gender stereotype on science performance, data is analyzed under the categories of: level of gender stereotype across gender and relationship between gender stereotype and science performance.

4.4.1 Level of Gender Stereotype across Gender

The following table presents the results of Gender Stereotype Scale analyzed in terms of means across gender derived from an independent-samples t-test.

Table 4.5: Level of Gender Stereotype across Gender

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Gender	MALE	200	1.6587	.50484	.04515
Stereotype	FEMALE	127	1.6740	.45222	.06395

Table 4.5 presents mean scores for gender stereotype across gender. The overall mean score for boys is 1.66 and the overall mean for girls is 1.67. This implies that the level of gender stereotype is low for both males and females in Migori county since a mean of 1 and 2 denoted strongly disagree and disagree respectively. However, girls rank higher in the level of gender stereotype than the boys. In order to establish if the mean difference in gender stereotype between the mean for boys and that for girls meets statistical significance level, results from the independent samples t-test was used at $\alpha = .05$ (two-tailed). Table 4.6 displays the analysis 'results.

Table 4.6: Test of Significance for the Gender Difference in the Level of Gender Stereotype

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Gender Stereotype	Equal variances assumed	3.850	.051	-.19	325	.852	-.01533	.08208	-.17734	.14667
	Equal variances not assumed			-.19	100.1	.845	-.01533	.07829	-.17065	.13998

Table 4.6 displays the output of the result analysis which indicates that the fundamental assumption for t-test regarding the equality of variances was not satisfied. No significant difference existed in the results for Males (*M*=1.66, *SD*=.50) and Females (*M*=1.67, *SD*=.45); at $\alpha = .05$ t (325) = -.187, p = .852. Therefore, although females have a higher level of gender stereotype than boys, this difference is not statistically significant.

This finding corroborates the findings of Onyeizugbo (2003) which despite not noting a statistical difference in the levels of gender stereotype across gender, asserted that "sex roles are somewhat rigid in Africa, particularly in Nigeria where gender differences are emphasized. It is common place to see gender stereotypes manifested in the day-to-day life of an average Nigerian. Certain vocations and professions (medicine, engineering and architecture) have traditionally been regarded for men and others (nursing, catering, typing, and arts) for women. Even though these rigid sex roles are held more by males than females, the patriarchal nature of the society forces females to internalize and accept them as truths."

The current finding is also in agreement with another study carried out in Kenya by Ayoo (2002) which asserted that gender stereotypes are mainly in favour of boys in Kenya and the girl-child is left to battle it out alone in a male dominated field of academics. As such, with the negative gender stereotype beliefs being in favour of the boys, they acquire greater belief in gender stereotype than the girls. However, just like the current study, this study did not establish a statistical significance in variation in the level of gender stereotype across gender.

4.4.2 Relationship between Gender Stereotype and Science Performance

Before proceeding to conduct a regression analysis it is imperative that a correlation analysis is conducted to ascertain whether a relationship exists between the variables to be regressed upon each other. A correlation analysis was therefore conducted between gender stereotype and science performance as summarized as below.

Table 4.7: Gender Stereotype and Science Performance Correlation Analysis Summary

Description	Statistics	Implication
Correlation between gender stereotype and performance in science	*r*= -.178 (*p*=.019, *n*=327)	Increase in gender stereotype is associated with a decrease in science performance.
Correlation when data is disaggregated by gender	Boys: *r*=-.211 (*p*=.018, *n*=200) Girls: *r*=-.171 (*p*=.035, *n*=127).	The correlation between the two variables was negative, significant and stronger for both the boys and girls.

From the table, it is evident that the overall correlation between gender stereotype and performance in science was found to be statistically significant at α=.05 with *r*= -.178 (*p*=.019, *n*=327). Thus, an upward movement in gender stereotype is linked to a downward decline in science performance. When data were disaggregated by gender, the correlation for gender stereotype and performance in sciences for both the gender was found to be statistically significant at α=.05 with boys having a *r*=-.211 (*p*=.018, *n*=200) and the girls having a *r*=-.171 (*p*=.035, *n*=127). Put differently, the correlation between the two variables was positive, significant and stronger for both the boys and girls. This outcome suggests that it is accurate to predict performance in science from gender stereotype for both the gender.

Considering that the correlation between gender stereotype and science performance was statistically significant for both gender, Table 4.8 is a linear regression output for predicting performance in science from interest for both the gender.

Table 4.8: Regression Model Summary for Gender Stereotype and Science Performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.178[a]	.032	.026	13.27205

a. Predictors: (Constant), Gender Stereotype

Based on the value of R, the results above indicate that there is a .178 correlation between the observed and predicted values of the dependent variable while the value of R Square indicates that 3.2% of the variance in science performance can be predicted by gender stereotype.

To test the model's significance, ANOVA statistics was used at α=.05. If Sig. is < α (.05), then the relationship is significant and vice versa. Table 4.9 illustrates ANOVA test for the relationship between gender stereotype and science performance.

Table 4.9: ANOVA Test for Gender Stereotype and Science Performance Model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	995.921	1	995.921	10.621	.019[b]
	Residual	30473.473	325	93.765		
	Total	31469.394	326			

a. Dependent Variable: SCIENCE
b. Predictors: (Constant), Gender Stereotype

As evident in Table 4.9, the results portray that the model significantly predicts science performance, F (1,325) =10.621, $p < .05$.

To test the null hypothesis, the regression coefficients is used. The criterion for acceptance or rejection of the hypothesis is based on the level of the p-value in relation to the α (.05). If the p-value is > .05 then we accept the null hypothesis while if the p-value is < .05 then we reject the null hypothesis. Table 4.10 displays the findings of the regression coefficient for the influence of gender stereotype on science performance.

Table 4.10: Prediction of Performance in Science from Gender Stereotype

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	44.940	3.565		12.606	.000
	Gender Stereotype	-4.891	2.057	-.178	-2.378	.019

a. Dependent Variable: SCIENCE

Table 4.10 shows that gender stereotype has a B weight of -4.891, a Beta weight of -.178 and a t-value of -2.378. From the B-value interpretation, for every 1 unit increase in the level of gender stereotype, there is a corresponding negative 4.891 unit decrease in the predicted science performance. With a p-value of .019, this relationship is significant at a p-value <.05. The null hypothesis of the 1st objective is therefore rejected.

To get the statistical model that allows for prediction of the outcome variable based on the predictor variable, the following statistical equation is used:

$$Y=\beta_0 + \beta_1 X$$

- Where Y represents the outcome variable

- And X represents the predictor variable

In substitution:

Science Performance = 44.940+(-4.891*Gender Stereotype)

Therefore, by inserting the level of gender stereotype into this equation, we can predict the level of science performance.

This finding echoes the qualitative finding from the FGD. The respondents' general opinion during the discussions was that the society played a very big role in continuing to promote gender bias in the field of science. The gender stereotype held by society against female science performance was a major cause of the problem of poor science performance. A story shared by one female respondent gave the deeply rooted barriers erected by society against females' success in science. She reported that:

> *One day when our family went to visit a family friend, the issue of careers came up. Children were asked their careers of choice and when I said I wished to pursue a career in Civil Engineering, the whole gathering roared with laughter. Condemnation upon condemnation at how that was a totally wrong career choice followed. I was told by my own father that I should stop being over ambitious but when I pointed out that I had been posting good grades in sciences he told me that that was at a very basic level and that the science at the university level was too technical to be handled by girls' brains. The wife to one of his friends told me that sciences are for men and that I should pursue a female career if I wanted to excel in life as a woman. I felt so frustrated and disappointed in myself for having believed I could succeed in science and from that day my performance in science has ever been on a terrible decline.*

After this experience she lost interest in sciences and her performance begun to decline very fast. This same scenario affected most girls as when they reported having interest in pursuing science careers at the university, they were criticized for intending to venture in a male field. The society seemed to glorify male science role models while cast aspersions on prowess of female science role models. Participants reported that the females who had succeeded in science were said to have not done so out of their own effort but from assistance by males around them and so girls were left without genuine role models in science. One female participant reported that:

> *When I scored an A in Chemistry and became the best in that subject in last year's third term exams, I was accused of befriending our Chemistry teacher and that those were not my marks. My class members challenged me to bring my paper for their verification. However, upon finding no marking errors, they said the teacher had given me the exams plus the marking scheme and so I just collected what I had copied in his house. I felt so painful about this and this has ever affected my performance in Chemistry a lot.*

Generally, all the participants for the discussion were in agreement that the society has made it difficult for girls to excel in this the science field. A statement by one male participant seemed to summarize this problem. He reported that:

> *As a woman, nobody, from your teachers, friends, parents and society as a whole believe you can make it in science. Everyone believes you have no capacity to excel in this field and as soon as this thought gets into one's brain, they switch off. From here the performance begins to go down and therefore unless nothing happens this field will forever be dominated by males.*

One area of science performance that has been so affected by gender stereotype is, Physics. Majority of students came out as holding very negative gender stereotype beliefs about Physics. One student reported that:

> *The performance of girls in Physics is so poor. Physics is a male subject and I believe girls should keep off Physics, it is not their field. Why should you go for a subject that you definitely know you cannot excel in? The kind of difficult calculations in Physics cannot be handled by girls and that is why the few pretenders who risk to choose it perform terribly.*

It was surprising that even the girl students had the same notion of them not being able to perform as well as boys in Physics. One girl responded that:

> *I believe girls cannot compete boys in Physics. Physics is full of boring and difficult stuff that can only be handled by boys. At some point I even regret having chosen this subject because it is turning out to be too technical for me. Again, the thought of being an Engineer scares me. With all the physical work and sweat involved in Engineering, I think it would be so boring, but it's too late to drop it anyway.*

In general, most of the respondents were in agreement with the notion that girls perform weaker than boys in Physics. One male participant summed it up by saying that:

> *Physics has over the decades been presented by society as a male subject and over time this fact has continued to sink in the minds of many, both girls and boys alike. This is what has actually led to many girls shying away from doing this subject and those who do it in most cases end up performing poorly as they believe they can't do better in it even if they try. I think time has come to reverse this trend and we should find actual reasons why there is this gender disparity so that we solve this problem once and for all.*

The current finding echoes those of previous studies by Spelke (2005), Murphy and Whitelegg (2006), Else-Quest et al. (2010), Raviv et al. (2003), Gilbert (2001) and Brickhouse et al. (2000), who found a direct link between negative gender stereotype comments and poor girl performance in science. Such comments were also blamed for the low numbers of girls in science classes as the comments made the girls feel as though science was a 'male field'. Similarly, Huguet and Regner (2007), Halpern, 2004), Blickenstaff (2005) concurs with these findings as their studies also revealed that negative stereotype beliefs greatly negatively affect girls' performance.

In concurrence with these findings are studies by Wigfield et.al. (2000) and Learch (2003), Onyeizugbo (2003) and Kakonge (2000) who go further to explain how negative gender stereotype beliefs impact science performance negatively. The studies opine that retrogressive socio-cultural beliefs can greatly hamper the girl-child's performance in the subjects of science and mathematics. For instance, parents in most cases believe that science and mathematics are a preserve of the boy child while on other end they believe that Arts and Languages are suitable for their daughters. They would therefore easily encourage their sons to pursue science-oriented courses beyond high school level while encourage their daughters to go for Art oriented courses.

Wigfield et.al. (2000) and Learch (2003), Onyeizugbo (2003) and Kakonge (2000) studies also identify teacher characteristics and the classroom environment as factors contributing to this gender gap. It is unfortunate that a lot of girls report not been accorded equal amount of opportunity to raise their comments during the discussion time as they are considered not good enough to raise important points. Gender stereotype has been normalized and taken as the daily norm. It is for this reason that careers of medicine, engineering and architecture have been specifically set aside for the male gender. The school being a part of the society has also taken part in propagating such beliefs spearheaded by the teachers themselves.

According to Arigbabu and Mji (2004) and Kashu (2014) students themselves have internalized these negative beliefs for they look at the scientists and mathematicians with the stereotype beliefs in their minds. Eventually, this translates to poor performance in math and science among girls as they see these subjects as a preserve for males. In such a concept, the girls consider themselves unable to become mathematicians and scientists. This reflects itself in poor female performance in such areas regarded as a ‘preserve of males. These studies therefore affirm the negative influence of gender stereotype on science performance.

4.5 Influence of Self-Efficacy on Science Performance

Influence of self-efficacy on science performance is analyzed under 2 sub themes of level of self-efficacy across gender and relationship between self-efficacy and science performance.

4.5.1 Level of Self-Efficacy across Gender

The following table presents the results of Science Self-Efficacy Scale analyzed in terms of means across gender derived from an independent-samples t-test.

Table 4.11: Level of Self-Efficacy across Gender

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Self-Efficacy	MALE	200	2.8056	.44925	.04018
	FEMALE	127	2.6980	.29381	.04155

Table 4.11 presents mean scores for science self-efficacy across gender. The overall mean score for boys is 2.81 and the overall mean for girls is 2.69. This implies that the level of self-efficacy

for boys was higher than that for girls. To be able to determine whether the difference in mean across gender has a statistical significance, the independent samples t-test was used at α=.05 (two-tailed). Table 4.12 displays result analysis' outcome.

Table 4.12: Test of Significance for the Gender Difference in the Level of Self-Efficacy

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	**Sig.**	***t***	***df***	**Sig. (2-tailed)**
Self-efficacy	Equal variances assumed	11.724	.001	1.564	325	.120
	Equal variances not assumed			1.862	136.37	.065

The table above indicates that the fundamental assumption for t-test regarding the equality of variances was violated at $\alpha < .05$ (F=11.724, p=.001). This notwithstanding, and assuming equal variances, the variations in self-efficacy across gender lacked statistical significance at $\alpha < .05$ (t (325) =1.564, p=.120). Table 4.12 therefore shows that although boys rank highly than girls in self efficacy level, this difference is not statistically significant.

This finding by the current study is in concurrence with those of Ochieng (2015) where he sought to establish the gender differences in the self-efficacy and Mathematics performance's relationship. The findings demonstrated that male students rank highly in the level of self-efficacy than female students. His study further revealed that males were able to show actual confidence in tackling Mathematical tasks unlike their female counterparts who were somewhat doubtful of their capabilities. However, just like the current study, his study failed to establish a significant difference in the levels of self-efficacy between males and females.

4.5.2 Relationship between Self-Efficacy and Performance in Science

Before proceeding to conduct a regression analysis it is imperative that a correlation analysis is conducted to ascertain whether a relationship exists between the variables to be regressed upon each other. A correlation analysis was therefore conducted between self-efficacy and science performance as summarized as below.

Table 4.13: Self-Efficacy and Science Performance Correlation Analysis Summary

Description	Statistics	Implication
Correlation between self-efficacy and performance in science	$r=.236$ ($p=.002$, $n=327$)	Increase in self-efficacy is associated with an increase in science performance
Correlation when data is disaggregated by gender	*Boys:* $r=.250$ ($p=.005$, $n=200$) Girls: $r=.185$ ($p=.018$, $n=127$)	The correlation between the two variables was positive, significant and stronger for both the boys and girls.

From the table, it is evident that the overall correlation for self-efficacy and performance in science's relationship attained a statistical significance level at $\alpha=.05$ with $r=.236$ ($p=.002$, $n=327$). Thus, an upward improvement in self-efficacy is associated with a corresponding upward movement in science performance. When data were disaggregated by gender, the correlation for self-efficacy and science performance for both the gender was statistically significant at $\alpha=.05$ with $r=.250$ ($p=.005$, $n=200$) for boys and $\alpha=.05$ with $r=.185$ ($p=.018$, $n=127$) for girls. Consequently, the regression analysis for the link between self-efficacy and performance in science was done for the different gender and presented as below.

Table 4.14: Regression Analysis for Self-Efficacy and Science Performance for Boys

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig
1	.199[b]	.040	.032	13.11321	5.059	.020

a. G = MALE b. Predictors: (Constant), Self-Efficacy

The results showed that indicate that there is a .199 correlation between the observed and predicted values of the dependent variable while the value of R Square indicates that 4.0% of the variance in science performance can be predicted by self-efficacy. In order to be able to test the model's significance, ANOVA statistics was used at α=.05. If Sig. is < α (.05), then the relationship is significant and vice versa. The results from ANOVA statistics infused above indicate that the model is a significant predictor of science performance for boys, $F(1,198) = 5.059$, $p < .05$.

Table 4.15 presents the regression analysis for girls.

Table 4.15: Regression Analysis for Self-Efficacy and Science Performance for Girls

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig
1	.162[b]	.034	-.017	11.98744	.464	.037

a. G = FEMALE

b. Predictors: (Constant), Self-Efficacy

The findings revealed that there is a .162 correlation between the observed and predicted values of the dependent variable while the value of R Square indicates that 3.4% of the variance in science performance can be predicted by self-efficacy. To ascertain the model's significance, ANOVA statistics was used at α=.05. The results from ANOVA statistics infused above indicate that the model is a significant predictor of science performance for girls, $F(1,125) = .464$, $p < .05$.

Therefore, put differently, the two variables' correlation was positive, significant and stronger for both the gender. This outcome therefore makes the suggestion that it is accurate to predict performance in science from the level of self-efficacy for both females and females.

Considering that the correlation between science self-efficacy and performance in science was statistically significant for both the gender, Table 4.16 is a linear regression output for predicting performance in science from self-efficacy for both the gender.

Table 4.16: Prediction of Performance in Science from Self-Efficacy

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	22.666	7.447		3.044	.003
	Self-Efficacy	5.896	2.621	.199	2.249	.026

a. G = MALE

b. Dependent Variable: SCIENCE

Table 4.16 shows that self-efficacy has a B weight of 5.896, a Beta weight of .199 and a t-value of 2.249. From the B-value interpretation, for every 1 unit increase in the level of self-efficacy, there is a positive 5.896 unit increase in predicted science performance. With a p-value of .026, this relationship is significant at a p-value <.05. The null hypothesis of the 2nd objective is therefore rejected.

To get the statistical model that allows for prediction of the outcome variable based on the predictor variable, the following statistical equation was used:

$$Y=\beta_0 + \beta_1 X$$

- Where Y represents the outcome variable
- And X represents the predictor variable

In substitution:

Science Performance = 22.666+(5.896*self-efficacy)

Therefore, by inserting the level of self-efficacy into this equation, we can predict the level of science performance. The current study therefore affirms that self-efficacy influences science performance among boy students in Migori county. This implies that an improvement in the level of self-efficacy leads to an improvement in the science performance and therefore the more self-efficacious one is in science, the higher their level of science performance.

This is consistent with the findings from the FGD where participants were of the opinion that the level of confidence one has in science determines their level of performance in science. One male participant reported that:

> *You see, there is no way one can do what he or she feels is difficult. I do well in sciences since I am quite confident about my ability. At times I come across very challenging tasks but the fact that I believe in my capabilities, makes me go out of my way and succeed. And therefore, self-efficacy is key in science performance and that is why those who doubt their abilities in science always fail in very simple tasks that don't require much effort.*

This finding is in consistence with the findings of Simpkins, Davis-Kean and Eccles (2006), Britner (2002, 2008); Britner and Pajare (2001, 2006); Zeldin and Pajares (2000), Hu, and Garcia (2001) and Silver, Smith and Greene (2001) who found that science self-efficacy and science performance had a relationship. Their studies established that Science self-efficacy has the ability to influence Science performance. Self-efficacy predicts academic performance at the highest level than other causal factors such as past performance through triggering cognition.

Similarly, studies by Diane (2003), Yazachew (2013), Aurah (2017), Farkota (2003) and Mustafa, Esma and Ertan (2012) which also agree with the current study's finding that a student's self-efficacy is essential in his/her Science academic performance and positively impacts on achievement. Highly efficacious students generally perform better in academic tasks. This happens since a higher level of self-efficacy makes them go for challenging tasks with confidence. As a result of practise they end up excelling. This therefore explains the results of the current study as the high level of self-efficacy made students to approach challenging tasks and hence the good performance.

However, the current study's finding contradicts that of Titilayo, Oloyede and Adekunie (2016) who established a zero relationship between chemistry students' academic achievement and self-efficacy in Nigeria. This study however focused on Chemistry alone and left out other science subjects which may have led to variation of the results. The failure to have a relationship between these two constructs of self-efficacy and science performance could therefore be explained by the fact that Chemistry alone does not represent the entire science domain and hence the lack of a relationship could have occurred due to focus on just one segment of science. Consequently, the lack of influence could be as a result of the fact that their study used Chemistry self-efficacy scale which just focused on Chemistry alone whereas the current study focused on science self-efficacy scale which focused on all science subjects.

4.6 Influence of Interest on Science Performance

Influence of interest on science performance was looked at under the sub-sections of level of interest across gender and relationship between interest and s science performance as follows.

4.6.1 Level of Interest across Gender

Table 4.17 presents mean scores for interest across gender derived from an independent-samples t-test.

Table 4.17: Level of Interest across Gender

	G	N	Mean	Std. Deviation	Std. Error Mean
Interest	MALE	200	2.9872	.83656	.07482
	FEMALE	127	2.7280	.29070	.04111

The table shows that the overall mean score for boys is 2.99 and the overall mean for girls is 2.73. This implies that the level of interest for boys was higher than that for girls. In order to establish if the mean difference in interest between the mean for boys and that for girls has a statistical significance or not, results from the independent samples t-test was used at $\alpha < .05$ (two-tailed) as shown below:

Table 4.18: Test of Significance for the Gender Difference in the Level of Interest

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Interest	Equal variances assumed	1.446	.231	2.137	325	.034	.25920	.12131	.01977	.49863
	Equal variances not assumed			3.036	170.781	.003	.25920	.08537	.09067	.42773

Table 4.18 displays the analysis' outcome which indicates that the fundamental assumption for the t-test regarding the equality of variances was satisfied. There was a significant difference in the scores for Males (*M*=2.99, *SD*=.84) and Females (*M*=2.72, *SD*=.29); at $\alpha = .05$ $t\ (325) = 2.137$, $p = .034$. The results above suggest that difference in the level of interest across gender was statistically significant. Specifically, male students score highly in interest in science than female students.

4.6.2 Relationship between Interest and Science Performance

Before proceeding to conduct a regression analysis it is imperative that a correlation analysis is conducted to ascertain whether a relationship exists between the variables to be regressed upon each other. A correlation analysis was therefore conducted between interest and science performance as summarized as below.

Table 4.19: Interest and Science Performance Correlation Analysis Summary

Description	Statistics	Implication
Correlation between interest and performance in science	*r =.253 (p=.001, n=327)*	Increase in interest is associated with an increase in science performance
Correlation when data is disaggregated by gender	*Boys: r =.221 (p=.013, n=200)* *Girls: r=.297 (p=.036, n=127)*	Correlation between the two variables was positive, significant and stronger for both boys and girls

From the table, it is evident that the overall correlation between interest and performance in science was found to be statistically significant at α=.05 with *r* =.253 (*p*=.001, *n*=327). Thus, an improvement in the level of interest is associated with a corresponding improvement in science performance. When data were disaggregated by gender, the correlation between interest and performance in science for boys was statistically significant at α=.05 with *r* =.221 (*p*=.013, *n*=200). The correlation between interest and performance in science for girls was also statistically significant at α=.05 with *r*=.297 (*p*=.036, *n*=127). Thus, an improvement in the level of interest is associated with a significant corresponding improvement in science performance for both the gender.

Consequently, a regression estimate for the relationship between interest and performance in science for both males and females was worked out and found to be significant. Interest explained 4.9% of the variance in science performance for boys and 8.8% for girls. Put differently, the correlation between the two variables was positive, significant and stronger for both the gender. This outcome implies that it is accurate to predict performance in science from interest for both the gender. Considering that the correlation between interest and performance in science was statistically significant for both gender, Table 4.20 is a linear regression output for predicting performance in science from interest for both the gender.

Table 4.20: Regression Model Summary for Interest and Science Performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.253[a]	.064	.059	13.04698

a. Predictors: (Constant), Interest

Based on the value of R, the results above indicate that there is a .253 correlation between the observed and predicted values of the dependent variable while the value of R Square indicates that

6.4% of the variance in science performance can be predicted by interest. To test the significance of the model, ANOVA statistics was used at α=.05. If Sig. is < α (.05), then the relationship is significant and vice versa. Table 4.21 illustrates ANOVA test for the relationship between interest and science performance.

Table 4.21: ANOVA Test for the Significance of Interest and Science Performance Model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2020.690	1	2020.690	22.301	.001[b]
	Residual	29448.704	325	90.6114		
	Total	31469.394	326			

a. Dependent Variable: SCIENCE

b. Predictors: (Constant), Interest

As evident in Table 4.21, the results indicate that the model is a significant predictor of science performance, F (1,325) =22.301, p < .05.

To test the null hypothesis, the regression coefficients was used. The criterion for acceptance or rejection of the hypothesis is based on the level of the p-value in relation to the α (.05). If the p-value is > .05 then we accept the null hypothesis while if the p-value is < .05 then we reject the null hypothesis. Table 4.22 presents the results of the regression coefficient for the influence of interest on science performance.

Table 4.22: Prediction of Performance in Science from Interest

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	23.250	4.056		5.732	.000
	Interest	4.653	1.351	.253	3.445	.001

a. Dependent Variable: SCIENCE

Table 4.22 shows that interest has a B weight of 4.653, a Beta weight of .253 and a t-value of 3.445. From the B-value interpretation, for every 1 unit increase in the level of interest, there is a positive 4.653 unit increase in predicted science performance. With a p-value of .001, this relationship is significant at a p-value <.05. The null hypothesis of the 3rd objective is therefore rejected.

To get the statistical model that allows for prediction of the outcome variable based on the predictor variable, the following statistical equation was used:

$$Y=\beta_0 + \beta_1 X$$

- Where Y represents the outcome variable
- And X represents the predictor variable

In substitution:

Science Performance = 23.250+(4.653*Interest)

Therefore, by inserting the level of interest into this equation, we can predict the level of science performance.

The current study therefore affirms that interest influences science performance among secondary school students in Migori county. This implies that an increase in the level of interest leads to a significant increase in the level of science performance and therefore the more one is interested in science the higher the level of science performance.

This finding concurs with the findings from the interview of the HOSD who affirmed that interest is very instrumental in science performance. Interest was reported to be the reason for science performance difference as those who had no interest in science shied away from it and hence the low performance among such students and vice versa. One HOSD reported that:

> *I think the main determiner of science performance is interest. If one has no interest then definitely, he/she will end up failing. I have for example seen students who positively change their performance in science by merely developing interest in science. Teachers also play a very key role in the students' level of interest in science. You may find that when a teacher is changed and a new one comes in, students may develop interest or dislike for that particular subject based on the teacher. Eventually depending on what happens, the level of science performance changes. And therefore, a change of attitude by teachers is key in determining the level of science performance as most science teachers are a bit unfriendly hence lowering the level of interest in those subjects.*

This result affirms findings by previous studies such as Trumper (2006), Elster (2007), Logan and Skamp (2008) and Adekunle and Femi-Adeoye (2016) who indicated that there is a positive influence of student's interest on science performance. They posit that students who are interested in the subject they are studying, including science, focus more attention and concentrate well on the subjects. As a result, students often learn more about the subjects in which they are interested. Those who are not interested in science subjects keep off these subjects and therefore fail to study them, this eventually leads to them getting low performance in science.

Zuckerman, Gagne, and Nafshi (2001) study which also affirm the findings of the current study also adds that those students who are interested in their science majors do well in their science majors and are least likely to change their majors. The same position is held by Rautta (2013) who posits that the better performance by male students in science subjects in the KCSE was as a result of gender disparity in interest. Boys have interest in the subjects of sciences as they are associated with masculinity and therefore, they dedicate a lot of their time to the subjects.

However, studies by Winne and Nesbit (2010) and Miller, Blessing and Schwartz (2006) Schwartz (2006) contradicts the current finding by finding no significant relationship between interest in science and science performance. However, these studies were carried out among college going students who had already chosen their science majors. Therefore, since these students had earlier indicated interest in science at the college entry level, they can all be assumed to be having a high level of science interest and hence no variations would be evident in their level of science interests. As such performance would cease to be a factor of interest as everyone would be assumed to be having a high level of interest and therefore the level of performance would be subject to personal effort and other factors.

4.7 Test of Fitness of the Overall Model

To test whether the proposed model is a good model for explaining science performance, a Multiple Regression Analysis was used. Gender stereotype, self-efficacy and interest were entered as the predictor variables alongside performance in science as the predicted variable and run using the Enter Method. The following results in Table 4.23 presents the regression model summary.

Table 4.23: Regression Model Summary for influence of Multiple Factors on SP

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.363[a]	.131	.111	12.68012

After entering all the 4 independent variables, R is equal to 0.363 which describes a correlation between independent variables and the dependent variable. R square is equal to 0.131 while Adjusted R square is .111. Based on the R Square statistics this implies that 13.1% of changes in dependent variable (science performance) is explained by these independent variables.

To test the significance of the relationship, ANOVA statistics was used. Table 4.24 illustrates ANOVA test for the link between the predictor variables and the predicted variable.

Table 4.24: ANOVA Test for Significance of Multiple Factors on SP

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	4135.883	4	1033.971	6.431	.000[b]
1	Residual	27333.512	322	160.785		
	Total	31469.394	326			

a. Dependent Variable: SCIENCE

As evident in Table 4.24, the results indicate that the model is a significant predictor of science performance, F =6.431, $p < .05$. As evident in Table 4.24, with a P-value= 0.000 it can be concluded that the F is significant at a p-value less than the optimal 0.05. The proposed model is therefore a good model for predicting science performance. Thus, all the independent variables combined have a significant influence on the dependent variable. Therefore, a combined increase in all the 3 independent variables collectively leads to an increase in science performance. However, the manner in which these 3 independent variables interact with one another to influence performance in science was above the scope of this study and could therefore form basis for further research.

In order to establish which variables have the greatest effect on the predicted value, the standardized coefficients (Beta) were used. Standardized coefficients are used since all the variables are standardized to have a mean of zero and a standard deviation of one and therefore all the variables are expressed in the same unit. Table 4.25 displays the output of coefficients.

Table 4.25: Predicted Science Performance from Multiple Factors

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.238	8.146		1.871	.063
	Gender Stereotype	-4.923	1.962	-.179	-2.510	.013
	Self-Efficacy	5.885	2.325	.181	2.531	.012
	Interest	4.608	1.311	.251	3.516	.001

a. Dependent Variable: SCIENCE

From the above table, the standardized coefficients show that interest has the highest magnitude of positive effect on science performance at .251 followed by self-efficacy at .181 while gender stereotype has the least magnitude of negative effect of -.179 on science performance. It is also evident that all the 3 variables have a significant effect on science performance at a p-value <.05.

4.8 Gender as a Moderator in the Influence of Gender Stereotype, Self-Efficacy and Interest on Science Performance

In order to examine this fourth hypotheses, moderated regression analysis was conducted. To do this, PROCESS by Andrew F., Hayes was installed in SPSS and used to run the moderation analysis. PROCESS by Andrew F., Hayes does the centering and standardization of the variables as well as creating the interaction term automatically (Andrew, 2017). Moderation analysis was conducted under the sub sections of gender as a moderator in the relationship between gender stereotype and science performance, gender as a moderator in the relationship between self-efficacy and science performance and gender as a moderator in the relationship between interest on science performance as follows:

4.8.1 Gender as a Moderator in the Relationship between Gender Stereotype and Science Performance

To test the moderating role of gender on the relationship between gender stereotype and science performance, gender stereotype was keyed in as the independent variable (X), science performance was keyed in as the dependent variable (Y) while Gender was keyed in as the moderating variable (M) in SPSS's PROCESS by Andrew F., Hayes and run. The Moderated regression table below shows the B-value which is the unstandardized coefficient and is compared to zero using a t-test which is computed from the Beta divided by its Standard Error. The level of significance is set at a p-value $< \alpha$ (.05).

Table 4.26: Regression Table for Gender as a Moderator in the Gender Stereotype and Science Performance Relationship

Regression Model Summary				
Model	**B**	**SE**	**t**	**p**
Intercept	36.7956	.9549	38.5349	.0000
Gender Stereotype	-4.6364	2.2386	-2.0711	.0398
Gender	-8.3581	2.0194	-4.1389	.0001
Gender Stereotype x Gender	3.2227	5.6511	.5703	.5692

Table 4.26 indicates the results for moderation analysis. To determine the effect of moderation, we use the results for the interaction variable (Gender Stereotype x Gender). This result shows that B=3.2227, Standard Error=5.6511, t=.5703 and p=.5692. From this it is evident that gender has an interaction effect of 3.2227. However, with a p-value of .5692 which is greater than the α (.05), this interaction effect is considered non-significant and therefore the null hypothesis 4.1 is accepted. In a nutshell therefore, gender does not significantly alter the level of influence of gender stereotype on science performance. This implies that the effect of gender stereotype on science performance does not change when we consider a single gender.

This finding affirms the assertions that came from the FGD that blamed gender stereotype for the poor performance in science by both males and females. The discussions were of the agreement that those who hold onto these beliefs are more likely to have a weaker performance in science. An extract from one discussion read that:

The gender stereotype beliefs are indeed a problem to the performance of both boys and girls. The boys who hold tightly on to these beliefs tend to take much of their time criticizing female gender to the point that they cannot even wish to get assistance from girls with good science performance or involve themselves in group discussion in science subjects with girl students. They even go to the extent of failing to believe the female science teachers since according to them a female cannot have the ability to teach the science subjects. Ultimately, these boys perform poorly in science. Likewise, girls who hold onto these beliefs shy away from the science subjects and eventually end up performing poorly.

The same sentiments came from the interview of the HOSD. They were of the opinion that the gender stereotype beliefs' effect cuts across gender. An extract from the interview read that:

From my knowledge and experience, both boys and girls who hold onto these beliefs perform poorly. Rarely would you find boys with good science performance holding onto these beliefs. In most cases they are open minded and either support or listen to female students during discussion and in the process perfect their knowledge in science. They also listen to female science teachers without any prejudice. It is only the boys who are poor in science performance who hold onto these beliefs as an ego defense mechanism to compensate for their inferiority. Likewise, the girls who are good in science performance rise above these beliefs since they know they are mere negative notions that are not true.

These findings echo those of Stake (2003) established in her research that the more the boys and girls held onto these beliefs the worse their performance in science became. This study established that gender stereotype influences the science performance among science students but there was no significant deviations in terms of gender. This reflects the situation in the current study where gender was not able to alter the level of influence between gender stereotype and science performance.

However, these findings contradict those of previous studies by Chimombo (2000), Ochwa-Echel (2011) and Chepchieng and Kiboss (2004) who established that gender influences the relationship between gender stereotype and academic performance. With cultural beliefs looking at girls being unable in science, girls more than boys become affected by such beliefs and they lose hope in science, hence end up performing poorer than boys.

According to Chimombo (2000) these negative stereotype beliefs if practiced in a classroom environment, they would make the girl student feel left out and would in the end perform poorly in science. Similarly, Ochwa-Echel (2011) adds that these gender barriers particularly affect the girl child and as such they find it difficult to cope and concentrate in school. By the end of the day, the girl-child ends up having a weaker performance in science than the males. However, the findings of these studies were based on female students alone and therefore left out the male gender. This therefore failed to establish moderation effect where both the gender are involved as is the situation in the current study. These findings therefore cannot be applied to the current study.

Accordingly, Chepchieng and Kiboss (2004) notes that whenever the issue of gender stereotype arises, girls are at a disadvantage. It is such disadvantages leveled against girls by retrogressive gender stereotype beliefs that result to weak girl achievement in academics in comparison to the boys. However, the findings of these studies were based on overall academic performance and therefore did not address the issue of science performance which is the focus of the current study. Their finding therefore cannot be conclusively relied upon to be reflecting the purpose of the current study.

4.8.2 Gender as a Moderator in the Relationship between Self-Efficacy and Science Performance

The Moderated regression table below shows the B-value which is the unstandardized coefficient. The level of significance is set at a p-value < α (.05).

Table 4.27: Regression Table for Gender as a Moderator in the Self-Efficacy on Science Performance Relationship

Regression Model Summary				
Model	**B**	**SE**	**t**	**p**
Intercept	36.7312	.9767	37.6060	.0000
Self-Efficacy	4.9261	2.5705	1.9164	.0070
Gender	-8.0345	2.0961	-3.8331	.0002
Self-Efficacy x Gender	-3.3947	6.8278	-.4972	.6197

Table 4.27 indicates the results for moderation analysis. To determine the effect of moderation, we use the results for the interaction variable (Self-Efficacy x Gender). This result shows that B=-3.3947, Standard Error=6.8278, t= -.4972 and p=.6197. From this it is evident that gender has a negative interaction effect of -3.3947. However, with a p-value of .6197 which is greater than the α (.05), this interaction effect is considered non-significant and therefore the null hypothesis 4.2 is accepted. In a nutshell therefore, gender does not significantly alter the level of influence of self-efficacy on performance in science. This implies that the effect of self-efficacy on science performance does not change when we consider a single gender.

The current study's finding agrees with that of Britner (2002, 2008); Britner and Pajare (2001, 2006); Zeldin and Pajares (2000), Hu, and Garcia (2001) and Silver, Smith and Greene (2001) who found an existence of a relationship between self-efficacy and science performance regardless of gender. That is whether one is male or female, self-efficacy influences science performance positively Therefore ones' gender cannot alter the level of effect of self-efficacy as the effect is the same across gender which actually reflects the findings of the current study.

However, Rayburn (2009), Mohammed and Zahra (2016), Akbaryboorang (2009), Ochieng (2015) and Aurah (2017) studies conflicted the findings of the current study by finding that gender des have a significant level of effect on the relationship existing between self-efficacy and performance in science. These studies note that boys tend to manifest a high level of self-efficacy in comparison with the girls in the field of science and in the long run boys end up performing well in science than females. However, the findings of Rayburn (2009) and Mohammed and Zahra (2016) were based on studies conducted among college going students and therefore came from a different cohort that is not captured by the current study and therefore their findings cannot fully apply to the current study. Consequently, Akbaryboorang (2009), Ochieng (2015) and Aurah (2017) did not run a moderation analysis to ascertain the relationship between these two variables and therefore their finding was as a result of assumptions coming from qualitative data given by students.

4.8.3 Gender as a Moderator in the Relationship between Interest and Science Performance

The Moderated regression table below shows the B-value which is the unstandardized coefficient. The level of significance is set at a p-value < α (.05).

Table 4.28: Regression Table for Gender as a Moderator in the Interest and Science Performance Relationship

Regression Model Summary				
Model	**B**	**SE**	**t**	**p**
Constant	37.2614	1.0270	36.2819	.0000
Interest	5.9891	1.5182	3.9448	.0001
Gender	-5.8986	2.4244	-2.4330	.0160
Interest x Gender	8.6149	5.1022	1.6885	.0331

Table 4.28 indicates the results for moderation analysis. To determine the effect of moderation, we use the results for the interaction variable (Interest x Gender). This result shows that B=-8.6149, Standard Error = 5.1022, t = 1.6885 and p = .0331. From this, it can be seen that gender has a positive interaction effect of 8.6149 which is significant at a p-value <.05, showing that interest and science performance relationship is indeed moderated by gender variable. The null hypothesis 4.3 is rejected as the moderation is significant at <.05. Since gender was only able to moderate the relationship between interest and science performance, there is therefore need for further research using other moderators such as age, intelligence and motivation to check the impact of these other demographical variables in the relationships between these predictors and science performance.

With the initial effect of interest before the introduction of the interaction variable being 5.9891 with a p-value of .0001 which is also significant at a p-value, .05, gender therefore moderates the relationship by increasing the level of effect of interest on science performance to 8.6149. In order to interpret the moderation effect, this study used the simple slopes analysis to determine moderation among the different gender. The simple slopes table below displays the Conditional Effect of X on Y at Values of the Moderator.

The table shows the results for two different regressions: the regression for interest as a predictor of science performance (1) when the value of gender is 0.5 (i.e., low). Because females were coded as 1, this represents the value for girls; and (2) when the value of gender is 1.5 (i.e., high). Because males were coded as 2, this represents the value of boys' end of the gender spectrum. B represents the effect of the predictor on the outcome (science performance) whereas p shows the significance pegged at <.05.

Table 4.29: Simple Slopes Analysis of the Effect of Gender on the Interest and Science Performance Relationship

Gender	Effect	SE	t	p
Male	5.989	2.020	2.965	.003
Female	9.892	4.597	2.152	.033

From Table 4.29, it is evident that males have an effect of 5.989 and a p-value of .003 whereas females have an effect of 9.892 and a p-value of .033. Since both female and males have a p-value<.05 these effects are considered significant. Therefore, for boys there is a significant effect of interest on science performance of 5.989 which is lower than that of females at 9.892. The results therefore show that the relationship between interest and science performance is different for both the gender. To indicate the different levels of effect of interest on science performance for males and females, the simple slope graph below was used.

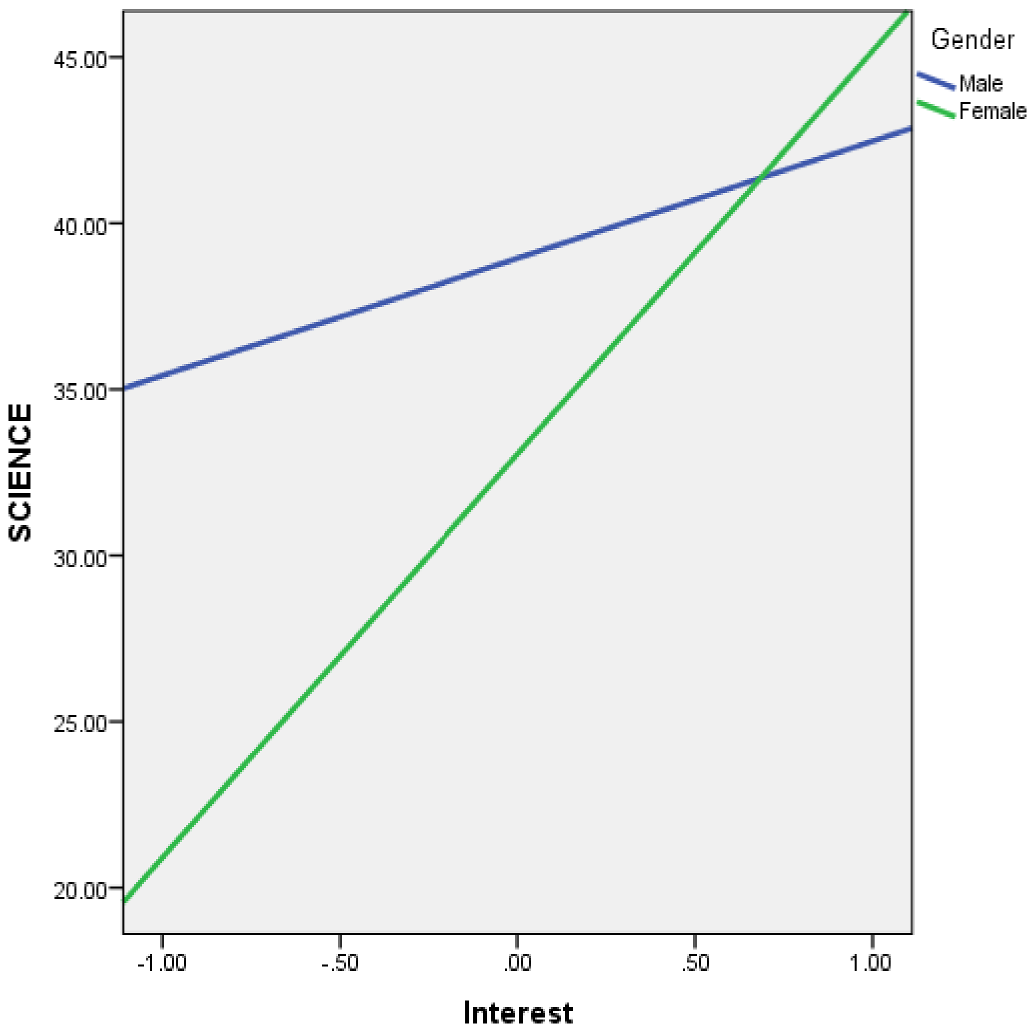

Figure 4.1 Simple Slope Graph

From Figure 4.1, male gender is represented by a blue line while female gender is represented by a green line. From the figure, it is evident that the effect is both on the same direction, which is positive indicating that for both males and females' interest positively influences the level of science performance. However, the relationship is so steep for females than males indicating that the effect is stronger for boys than girls. Consequently, the crossing of lines signifies a significant interaction effect (Moderation). Therefore, the study concludes that the influence of interest on science is higher among females than males.

This finding affirms the previous findings by Venkatesh and Morris (2000), Hidi and Renninger (2006) and Terzis and Economides (2011) studies who indicated a significant gender difference in the relationship between interest and science performance. The studies note that the gender factor has the ability to influence the level of the association between interest and science performance. The studies noted that girls were performing poorly in science since they lacked interest in science. Hence their level of performance in science would rise steadily if they developed interest. The studies were therefore able to draw a link between the high levels of interest and performance. They alluded that, high interest leads to dedication of much time and effort and hence translating to a better performance.

4.9 Findings on Ways of Solving Gender Disparity in Science

4.9.1 Emerging Themes and Thematic Analysis

The process of thematic content analysis involves identifying themes and categories that emerge from the data (Burnard, Gill, Stewart, Treasure and Chadwick, 2015). This involves discovering themes in the focus group discussion transcripts and attempting to verify, confirm and qualify them by searching through the data and repeating the process to identify further themes and categories (Burnard et. al, 2015). A theme is a cluster of linked categories conveying similar meanings and usually emerge through the inductive analytical process which characterizes qualitative paradigms (Blog & Resources, 2015). In the current study, the themes that emerged from interview sessions with the Heads of Science Department and Focus Group Discussions were: role model influence on science performance, student attitude towards science performance, teacher related factors on science performance and parental influence on science performance. The emerging themes are discussed below.

4.9.1.1 Role Model Influence on Science Performance

During a focus group discussion, when participants were asked on how the gender gap in science performance can be solved, one participant reported that:

> *"Girls perform poorly in science since they lack female role models in science. It is quite sad that those who do better in science are mainly boys and this makes us, girls see this field as a male field. How do you expect me to show great effort in a field that I know is not mine? If the gender gap is to be bridged then we must begin to see majority of women excelling in this field, that is what will inspire confidence in us to perform in this field."*

This statement was echoed by several other students who also asserted that lack of female role model in science is continuing to hurt girls' performance in this field. This is in agreement with the assertion that role model has a great influence on the performance of an individual and the weak performance in science may be a result of the lack of female role models in science field (Belkin, 2008). Consequently, various other studies have shown that role models can have a positive influence on science performance; for example, Wood (2000) found that girls participation increased substantially by exposing girls to female role models and permitting them to have a brief start in nurturing in an all-female environment.

Gilmartin et al. (2007) in their study found that middle and high school girls seem to especially benefit from same-sex role models in science careers. Consequently, research in Malawi shows that school girls lack female role models in science and mathematics subjects and this affects their skills, interest and attainment in these subjects. The ratio of women teachers in mathematics and science in most African countries is particularly low because so few women with the necessary science and mathematics' background get on to teacher training programmes.

In Education Management, girls have few role models to emulate. For example, in Zambia, out of 200 senior education officers in post in 1992, only 17 were women. The Zambian provinces with a high proportion of women teachers have high completion rates for girls. The positive impact of female head teachers on girls is considered stronger than that of female teachers (Kwesiga, 2002).

Likewise, Kashu (2014) study posits that girls perform poorly in science as they are exposed to negative role model in science as all the girls see is a weak performance from their fellow females. The study further opines that since girls tend to perform worse in mathematical and scientific subjects, they become ill-equipped to pursue these careers in higher education. This further leads to lack of female role models in science careers who can inspire the girls to excel in this area. All these studies therefore call for a need for there to be a role model in science for girls for them to begin to have a positive performance in science.

During the discussion, media too came out as playing a key role in forming role models in science. A participant remarked that:

> *Media must change its presentation of matters of science if we are to see an improvement in science. You know our generation is so dependent on what we see in social and official media that we actually consider what we see in media as the gospel truth. The images and information we see in media concerning science performance is so masculine. Those we see excelling in science are just boys and this leaves girls out in this field completely. This is a phenomenon that must change if we are expecting any improvement in science.*

A similar position was held by Blickenstaff (2005) on his study on the influence of media on science performance had students reporting that rarely are women portrayed as scientists in the media or textbooks. The study found that media has a negative influence on female students' science performance as opposed to male students who got the right motivation from the ideal male scientist portrayed in the media. He reckoned that media is a significant source of models for today‘s female youth as it can affect their self-efficacy through vicarious experiences

Unfortunately, female scientists portrayed in the media are rarely shown as knowledgeable experts; rather, they are usually the assistant to a man who is the expert. As a result, they are made to believe that science is a male field and therefore they lose interest in it thereby leading to their weak performance. This is contrary to male students who are motivated to perform well upon seeing male scientists excelling in the media (Barnett & Rivers, 2004).

According to Brownlow et al. (2000) this negative attitude about women in science contributes to girls' science anxiety which in turn results in them less likely to perform well in science. However, when media does portray a positive female science role model, it can have a significant impact on girls (Baker & Leary, 2003), including encouraging their interest in science and motivating them to perform well in science. All this serve to discriminate women in science and they are actually made to believe that this is a male field. It is even worse to note that this bias against women in media is also being practiced at school level as well. A participant pointed out that:

> *Our science books have glorified males as opposed to female students. Rarely would you find female pictures appearing on books as examples of students taking part in science. They pictures are normally for males and this makes the girls feel that this is a male field hence the weak performance in science. It is high time the curriculum implementers started thinking seriously on redoing some of the books so as to cover the female gender as well so that they see this field as all inclusive. It is only then that we will realize an improvement in girl performance.*

This goes hand in hand with the assertion that the image of science portrayed by media is also fostered in our schools through underlying bias in textbooks and curriculum design. Wood (2000) in a study on influence of print media on science performance found that Science textbooks for example have significantly more pictures of men than of women doing science. This made female students believe that science was a male subject and therefore were demotivated to perform well in science. However, it is worth noting that a lot of adjustments have been made on the science books with the new books having female pictures as well and therefore the gender bias only exists in old books.

However, contrary to the above findings a female Head of Science Department remarked that:

> *For the years I have served as a head of science department I have tried to enlighten the students particularly on various successful individuals in the field of science. I in particular was made a head of science department to inspire girls' performance in science and indeed many girls and even boys recognize me and even others as their role models in science but this has not translated to good performance in science. What normally happens is that the learners see the success of such role models as coming as a result of the exemplary qualities of the role models that they themselves lack.*

This therefore points out that role model in itself is not able to inspire good performance in science. For a role model to inspire this positive result, the student must be able to be made believe that what the role model achieved is actually achievable. This was alluded to during the focus group discussion by one student who said that:

> *My role model is my Mathematics teacher, he teaches us Mathematics so well but I keep on getting D's in Mathematics. I know I cannot get better than that because he is so clever and Maths is running in his blood but as for me however much I try I don't think I can get anything better. I long to be like him but his success is due to intelligence which I lack.*

This finding concurs with those of Carrington, Tymms and Merrell (2005, 2008), Martin and Marsh (2005), Elstad and Turmo (2009) and Weinburgh (20////00) who found no significant relationship between the role model and student science performance. According to their studies the most important factor in the performance of science is the quality of a teaching of science but not the role model in science performance. Consequently, it is worth noting that role model in itself cannot inspire a student's performance. These learners could have had role models but they didn't have anything they share in common with these role models and therefore they saw their achievement as out of attributes special in them.

This fact is echoed by Gilmartin et al. (2007, p. 984) who asserted that gender specific role models can be especially influential because students can identify better with someone who shares their background, especially for women in a traditionally male-dominated profession‖. Britner and Pajares (2006) in their study on role model influence on science found that modeling is more successful when the observers perceive similarities between themselves and the models. This may be particularly applicable to young women and minority students who may not often see themselves reflected in the faces of those who do science.

4.9.1.2 Student Attitude on Science Performance

Participants in the focus group discussions were able to note that girls had a very negative attitude towards science subjects. One female participant remarked that:

> *I just don't like sciences, they are not my thing. In fact they make me feel terribly bored up. Sciences are too tough and even if one tries you will always fail in them. I seriously hate these subjects to the fact that I don't even want to see the science teachers. To me I just find myself sleeping during science lessons. Unless something is done to reverse this, I think I'll always perform poorly in science.*

This assertion was echoed by several other students who showed a very negative attitude towards science subjects. This actually concurs with the findings of other studies such as Miller, Blessing and Schwartz (2006) which have found out that in general female students normally find science subjects not appealing to them as compared to the boys. In the study, the levels of students who wanted to major in the science subjects was worked out. The results indicated that fewer girls than boys chose to major in the science-oriented courses (Winne & Nesbit, 2010). Girls showed a lot of peer influence and most of them reported not putting effort in science since their friends too did not put effort in sciences. One student reported that:

> *I used to put a lot effort in science. In fact my grades were better but when I got to Form Three and hooked up with my current "mbogi" (group) things changed. They influenced me to believe that science is not a 'girl thing' and I started paying less attention to sciences. My current performance in science is so terrible that I don't think I will ever go back to my former performance. However, I believe if I had a better clique that is focused on science, I would do better in science.*

This is in line with the findings of a study by Blickenstaff (2005) girls stated a very negative influence of peers on their science performance. Girls stated that they feel that if they achieve in science, they are not as feminine. Osborne and Collins (2001) studied the influence of peers on female students' science performance. The study found that peers are influential on girls' beliefs and interests in science which eventually impacts on performance. The study went further to establish that generally science receives a high academic status and those students that do science are considered to be intelligent which may not be a desirable quality to most girls in middle or high school.

This is in accordance with the assertion that around middle school girls will often start to downplay their intelligence for fear of being isolated‖. It is within these critical years that girls' identities become lost within the dominant structure‖ (Buck, 2002, p. 30). The need to be a member of a group and belong is important for a girls' identity and social interactions (Breakwell et al., 2003). It therefore calls for a spirited effort to ensure that the negative attitude towards sciences is eradicated totally among the girls so that they begin to accept science as a female field as well

4.9.1.3 Teacher Related Factors on Science Performance

Discussions from the focus group discussions pointed out lack of female teachers in science as one of the factors contributing to the gender disparity in science. A student noted that:

> *If we are really serious about bridging this gender gap in science performance then we must ensure we have female teachers in science. Most girls are put off science since most of the teachers they see in science are males and therefore they fail to get inspiration to work hard or pursue this subject. Physics for instance is the worst, I have never been taught Physics by a female teacher in ever since I was born and therefore to me this is just a male subject. I do believe if we had more female teachers then the female students wouldn't feel left out in sciences and would therefore work hard to achieve what they see as achievable through their female teachers.*

This is in concurrence with Dentith (2008) study which asserts that the teacher plays a very key role in the performance of a student in the sciences. For girls choosing to study science, the teacher is very important – the teacher‘s ability to teach, the support provided by the teacher, and the teacher‘s approachability play a very key role in students' science performance (Dentith, 2008; Rosser, 2004). For most students, teacher's ability to teach and gender are more important in students' performance (Francis et al., 2008). Schmid (2010) study also showed that the gender of the teacher has a significant impact on the student's performance, both positive when taught by same sex and negative when taught by opposite sex. Simply put, girls have better educational outcomes when taught by women and boys are better off when taught by men (Dee, 2006, p. 71).

This is evident in Warrington and Younger (2000) study where girls specifically said that they were put off physics and chemistry because there were no female teachers in those subjects. A reversal to this sorry state would therefore greatly improve the girl student performance as the female teachers would act as an inspiration for the girls. Consequently, the male teachers hold very negative view of female students participation in science. A participant reported that:

> *Male teachers are the source of my failure in science and particularly Physics. The teachers tell us point blank that science is not for girls. A teacher would even ignore giving you a chance to answer a question when you raise your hands since he believes you cannot give a meaningful answer in science. A teacher once remarked when my friend and I offered ourselves for a science contest that the contest doesn't require flower girls. I felt so deeply hurt and from that day henceforth my result started going down. I just don't know what can be done but if there was a seminar where we could take all these male teachers of science so that they are told to change their perception towards the female student ability in science then I think we could solve this problem.*

This finding corroborates that of Kakonge (2000) study which found out that teachers hold very negative perceptions on female students on their ability in science. According to the study the teachers felt that female students were not as good as male students in science. In the long run the teacher's perception directly influenced science performance of student. It is therefore imperative that the number of female teachers in science should be increased so that we have more females in this field to help demystify the masculine tag associated with the field. This would also go a long way in changing the perception held by the male teachers of science that female students are not good enough to handle sciences.

However, several other studies of middle school students have contradicted the current finding by showing that the teacher does not have a significant impact on the students' science performance (Carrington, Tymms, & Merrell, 2008). Carrington, Tymms, and Merrell (2005) found that the quality of teaching is much more influential than the teacher itself. Carrington et al. (2005, 2008) noticed though that female teachers seem to bring out the best in both girls and boys. And girls tend to state that they have better relationships with their female teachers (Martin & Marsh, 2005).

Elstad and Turmo (2009) found the same to be true in their study of high school students in the relatively egalitarian society of Norway. While they note that girls seemed to connect better with female teachers as their role models and felt female teachers created a better classroom environment, they reported that none of their findings was statistically significant (Elstad & Turmo, 2009).

Weinburgh (2000) in his study states that gender is a significant predictor on student attitudes toward the teacher and enjoyment of science but not science performance. However, these studies were all carried out in the Western nations which have overcome the gender barriers that we still have in African nations. The findings could therefore have come out as such due to the fact that gender is no longer a major issue in such societies. These findings could therefore not be taken as reflective of the situation in the local environment where we still have strong gender barriers against the female gender.

4.9.1.4 Parental Influence on Science Performance

Participants in the focus group discussion were able to bring out the great role played by the parents in determining the kind of performance they have in science. A participant reported that:

> *My father is to blame for the kind of performance I have in science. You see my brother and I are in the same class. He repeated class twice and I was able to catch up with him. But my father always buys him books for science subjects while he buys me books for English, Kiswahili and History. He constantly tells me that science is for boys and not girls. He gets shocked when I perform better in science than my brother and when my performance in science started going down he never bothered to even ask why. Instead, he put all his effort in improving my brother's performance in science, he even hired him 2 teachers of science subjects. As for me since he saw that I was doing good in Art subjects he never bothered to hire me a teacher to coffer me private tuition. Parents should be advised change their negative perception if we have to have an improvement in science.*

This is similar to the assertion that parental involvement in the life of a student cannot be over looked as well. Studies have shown that the parents offer a lot of support to the male children in order for them to excel in the field unlike the female children who are encouraged to pursue art-based careers. This support eventually translates to the boy child having a high level of self-efficacy in science and thereby performing better in science subjects (Catsambis, 2005). The above assertion is quite true as it is a reflection of Scott and Mallinckrodt (2005) study on the parental influence on children’s Science performance which found that fathers have a more significant impact on children’s science performance than mothers.

Scott and Mallinckrodt (2005) reckon that as a result of the fact that fathers are seen as career role models. They supported their findings by alluding that female scientists on their journeys to becoming women in science discovered that they too viewed their fathers as their main connection to science. These female scientists were motivated by their fathers’ role in the field of science and therefore worked hard to be like them (Mueller, 2004). Due to these findings it is therefore important that fathers are sensitized so that they take an active role in promoting female students participation in science activities so that there can be an improvement in science performance by the girls.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter contains summary of the research findings, conclusions of the study and recommendations.

5.2 Summary

The purpose of the current study was to establish the moderating role of gender in the influence of gender stereotype, self-efficacy and interest on science performance among secondary school students in Migori county. The summary and conclusions are presented according to the themes deduced from the research objectives that guided the study.

5.2.1 Influence of Gender Stereotype on Science Performance

The study established that:

There was a gender disparity in the level of gender stereotype. The average level of gender stereotype for males was 1.66 whereas that of females was 1.67. Thus, females had a higher belief in gender stereotype than their male counterparts.

However, there was no statistical significance in the difference in the scores for boys (*M*=1.66, *SD*=.50) and girls (*M*=1.67, *SD*=.45); at $\alpha = .05$ t (325) = -.187, p = .852.

In regards to the influence of gender stereotype on science performance, gender stereotype has a B weight of -4.891, a Beta weight of -.178 and a t-value of -2.378. From the B-value interpretation, for every 1 unit increase in the level of gender stereotype, there is a corresponding negative 4.891 unit decrease in predicted science performance. With a p-value of .019, this relationship is significant at a p-value <.05. The null hypothesis is therefore rejected.

5.2.2 Influence of Self-Efficacy on Science Performance

The study established that:

Gender disparity existed in the level of self-efficacy. Boys registered a slightly higher level of self-efficacy of 2.8056 against the females' level of 2.6980. This was due to the fact that males felt slightly more confident to successfully tackle tasks in science subjects than female students.

However, the difference in self-efficacy between boys (M=2.8056, SD=.44925) and girls (M=2.6980, SD=.29381) was not statistically significant at $\alpha < .05$ (t (325) =1.564, p=.120).

In terms of the self-efficacy influence on performance in science, self-efficacy was able to predict science performance among boys and girls, Self-efficacy has a B weight of 5.896, a Beta weight of .199 and a t-value of 2.249. From the B-value interpretation, for every 1 unit increase in the level of self-efficacy, there is a positive 5.896 unit increase in predicted science performance. With a p-value of .026, this relationship is significant at a p-value <.05. The null hypothesis is therefore rejected.

5.2.3 Influence of Interest on Science Performance

This study established that:

Gender disparity existed in the level of interest. Boys registered a higher level of interest of 2.99 against the female students' level of 2.72. This was due to the fact that male students in Migori county had a slightly higher level of interest in science subjects than girls.

A significant difference existed in the scores for self-efficacy for boys (M=2.99, SD=.84) and girls (M=2.72, SD=.29); at $\alpha = .05$ t (325) = 2.137, p = .034.

In terms of the influence of interest on science performance, interest has a B weight of 4.653, a Beta weight of .253 and a t-value of 3.445. From the B-value interpretation, for every 1 unit increase in the level of interest, there is a positive 4.653 unit increase in predicted science performance. With a p-value of .001, this relationship is significant at a p-value <.05. The null hypothesis is therefore rejected.

5.2.4 Gender as Moderator on the Influence of Gender Stereotype, Self-Efficacy and Interest on Science Performance

- In the analysis of gender as a moderator in the relationship between gender stereotype and science performance, the results established that after introduction of the interaction variable, gender had an interaction effect of 3.2227. However, with a p-value of .5692 which is greater than the α (.05), gender does not significantly alter the level of influence of gender stereotype on science performance. That is, no significant alteration happens if the initial influence of gender stereotype on performance in science when a single gender is involved. The null hypothesis is thus accepted.
- Consequently, in the analysis of gender as a moderator in the relationship between self-efficacy and science performance, the study established that after introduction of the interaction variable, gender had a negative interaction effect of -3.3947. However, with a p-value of .6197 which is greater than the α (.05), gender does not significantly alter the level of influence of self-efficacy on performance in science. That is, no significant change occurs in the influence of self-efficacy performance in science when a single gender is involved. The null hypothesis is thus accepted.

- Lastly, in the analysis of the moderating effect of gender in the relationship between Interest and performance in science, the study established that after introduction of the interaction variable, gender had a positive interaction effect of 8.6149 which is significant at a p-value <.05, showing that gender moderates the relationship between interest and performance in science. The null hypothesis is thus rejected.

- With the initial effect of interest before the introduction of the interaction variable being 5.9891 with a p-value of .0001 which is also significant at a p-value, .05, gender therefore moderates the relationship by increasing the level of effect of interest on science performance to 8.6149.

- The simple slopes analysis revealed that males have an effect of 5.989 and a p-value of .003 whereas females have an effect of 9.892 and a p-value of .033. Since both female and males have a p-value<.05 these effects were considered significant. Therefore, the relationship between interest and science performance is different for males and females. The influence of interest on science is higher among females than males.

5.3 Conclusions

In light of the study's results, the following conclusions were made:

5.3.1 Influence of Gender Stereotype on Science Performance

Both female and male students in Migori county have a moderately low level of gender stereotype. Gender stereotype negatively influences the science performance's level. The more the student holds the gender stereotype notions, the lower the level of science performance and vice versa.

5.3.2 Influence of Self-Efficacy on Science Performance

Both male and female students in Migori county possess a moderately high self-efficacy level. Science Self-efficacy positively influences the level of science performance among students The higher the level of self-efficacy in science among the students the higher the level of science performance and vice versa.

5.3.3 Influence of Interest on Science Performance

Female students in Migori county possess lower levels of interest in science than their female counterparts. Since the female students have the negative stereotype beliefs directed towards them, they develop little interest in science than boys who have gender stereotype beliefs in their favour.

Interest in Science positively influences the level of science performance. The more a student is interested in science subjects, the higher his/her level of science performance and vice versa.

5.3.4 Gender as a Moderator on the influence of Gender Stereotype, Self-Efficacy and Interest on Science Performance

Gender does not moderate the influence of gender stereotype and self-efficacy on science performance. That is, an introduction of gender, does not elicit a significant effect on the already established level of influence of gender stereotype and self-efficacy on science performance.

However, gender moderates the influence of interest on science performance. That is, an introduction of gender, produces a significant improvement in the level of the already established level of relationship between interest and performance in science. The influence of interest on performance in science is higher among the female than the male students.

5.4 Recommendations

The study confirmed that gender stereotype, self-efficacy and interest influence science performance. However, there still exists gender disparity in the level of science performance. The study therefore came up with the following recommendations:

1) There needs to be meaningful intervention by the government and teachers to initiate public awareness campaigns to demystify existing negative stereotype beliefs that depict science as a preserve of the males through motivational talks, public barazas, official media

platforms and social media as these beliefs have shown to negatively impact on girls' science performance.

2) Since self-efficacy comes out as a strong pillar of science performance, the teachers and counselors alike should work towards building the students' self-efficacy level in science through the utilization of intrinsic reward and motivation of students and more particularly, the female students.

3) The Ministry of Education and teachers should create more interest in science as it impacts on science performance through organization of science field trips, extrinsic reward and creating more friendly STEM teaching atmosphere.

4) Since the gender stereotype and self-efficacy's influence on science performance is not affected by gender, there is need by teachers and the Ministry of Education to work towards reducing the gender stereotype level and improving the levels of self-efficacy for both the gender.

   However, since gender moderates the relationship between interest and science performance, there is need by teachers and the ministry of education to work towards improving the level of interest for the female students as their interest in science translates to higher performance in science so as to bring down the gender difference in science performance.

5.5 Suggestions for Further Research

Based on the findings of the current study, the following suggestions for further research were made:

1) Moderation of gender on the influence of gender stereotype, self-efficacy and interest on the practical element of science performance.

2) A STEM analysis of the moderation of gender on the influence of gender stereotype, self-efficacy and interest on science performance.

3) Mediation of Self-efficacy on the relationship between gender stereotype and science performance.

4) Mediation of interest on the relationship between gender stereotype and science performance.

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APPENDICES

APPENDIX A: CONSENT FORM

Carefully study the following information before consenting to take part in this study.

STUDY TITLE

GENDER DIFFERENCE IN THE INFLUENCE OF SELECTED FACTORS ON SCIENCE PERFORMANCE AMONG SECONDARY SCHOOL STUDENTS IN MIGORI COUNTY, KENYA

UNIVERSITY: MASENO UNIVERSITY
RESEARCHER: GOR POLYCARP OWINO
SUPERVISORS: PROF. LUCAS OTHUON
DR. QUINTER MIGUNDE

INVITATION

You are being asked to take part in this research study entitled Gender Difference in the Influence of Selected Factors on Science Performance among Secondary School Students in Migori County, Kenya. Your participation in this study is purely voluntary and depends on your willingness to be part of the study.

Researcher: Gor Polycarp Owino. E-Mail address: gorpolycarp@gmail.com. Tel: 0725736140

Supervisors:
Prof. Lucas Othuon. E-mail address: lothuonus@yahoo.com. Tel: 0714642524
Dr. Quinter Migunde. E-mail address: qmigunde@hotmail.com. Tel: 0735662872

Declaration by the Participant:

I do hereby consent to take part in this study.

____
Participant's Name

____
Signature   Date

APPENDIX B: INFORMATION SHEET

MASENO UNIVERSITY

P.O. BOX PRIVATE BAG

MASENO-KENYA

CONTACT DETAILS
GOR POLYCARP OWINO
P.O. BOX 99 SUNA-MIGORI
MOBILE NO. 0725736140
E-MAIL ADDRESS gorpolycarp@gmail.com

Dear Respondent,

As part of my PhD in Educational Psychology degree I am undertaking a research study entitled Gender Difference in the Influence of Selected Factors on Science Performance among Secondary School Students in Migori County, Kenya, You were chosen since you have gone through adequate learning of Science in the secondary school level and the results of this study will be purely used for the study's purpose and nothing else.

I would like you to assist me by completing the attached questionnaires as per the instruction given in each case. The completion time will take approximately 40 minutes and the questionnaires will thereafter be collected by the researcher upon completion by all respondents.

Your participation is fully voluntary and no one will be victimized whatsoever for failing to take part in this study.

The result of this study will remain highly confidential as the questionnaires will remain anonymous and data aggregated such that individual data cannot be identified.

We will provide a copy of the result to your school administration, which will make them available to you. In case of any queries or complaints kindly direct them to the above stated contacts.

Thank you for considering participating in this study.

APPENDIX C: GENDER STEREOTYPE SCALE (GSS)

SECTION A: GENERAL INFORMATION

Kindly indicate your gender by ticking the appropriate box.

Male: ☐

Female ☐

SECTION B: STATEMENTS

Please respond to the following questions using the scale provided by circling the response that corresponds to your level of agreement

1. Sciences are for men whereas Arts are for women.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

2. Boys' brains are better developed to handle sciences better than that of girls.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

3. Women cannot perform well in sciences even if they try as hard as possible.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

4. Men are better at math than women.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

5. Men generally understand technical subjects better than women.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

6. It is much more important for boys to go to university than girls.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

7. It is more natural for girls to help with housework than boys.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

8. It is fashionable for boys to study science courses in college/university but not girls.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

9. Physics is a male subject.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

APPENDIX D: SCIENCE SELF-EFFICACY SCALE

SECTION A: GENERAL INFORMATION

Kindly indicate your gender by ticking the appropriate box.

Male: ☐

Female ☐

SECTION B: STATEMENTS

HOW MUCH CONFIDENCE DO YOU HAVE THAT YOU COULD
STATEMENT

1. Explain Scientific terms?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

2. Choose an appropriate formula to solve a scientific problems?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

3. Carry out experimental procedures in the laboratory

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

4. Describe scientific processes?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

5. Correctly write scientific formulas and terms?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

6. Interpret findings during laboratory practical?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

7. Solve Mathematical problems using a log table?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

8. Interpret various equations?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

9. Explain the particulate nature of matter?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

10. Solve Mathematical problems?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

11. Correctly answer various questions in science subjects?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

12. Correctly observe results of laboratory experiments?

1. No confidence at all 2. Very little confidence 3. Much confidence 4. Complete confidence

THANK YOU FOR TAKING PART IN THIS STUDY

APPENDIX E: SCIENCE INTEREST SURVEY (SIS)

SECTION A: GENERAL INFORMATION

Kindly indicate your gender by ticking the appropriate box.

Male: ☐

Female ☐

SECTION B: STATEMENTS

Please answer the questions below honestly; there are no right or wrong answers. Please respond to the following questions using the scale provided by circling the response that corresponds to your level of agreement

1. Science subjects are interesting

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

2. Science subjects are fun.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

1. Learning sciences is important.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

2. I know a lot in science subjects.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

5. I do well in my science classes.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

6. Science subjects are easy for me.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

7. I go places to learn about science subjects outside of school.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

8. What I learn in science subjects is more useful than what I learn in other classes.

1. strongly disagree 2. Disagree 3. Agree 4. Strongly agree

APPENDIX F: SCIENCE ACHIEVEMENT TEST

SECTION A: GENERAL INFORMATION

Kindly indicate your gender by ticking the appropriate box.

Male: ☐

Female ☐

SECTION B: QUESTIONS

The following questionnaire is **NOT** a test. The questionnaire purely serves the purpose of research and nothing else. Answers given will not be known by any of your teachers. The questionnaire has 4 sections tackling the 4 science subjects of Physics, Biology, Chemistry and Mathematics. Kindly answer **ALL** the questionnaire by giving your best answer to them.

PHYSICS

1. Figure 1 shows a measuring cylinder containing some water

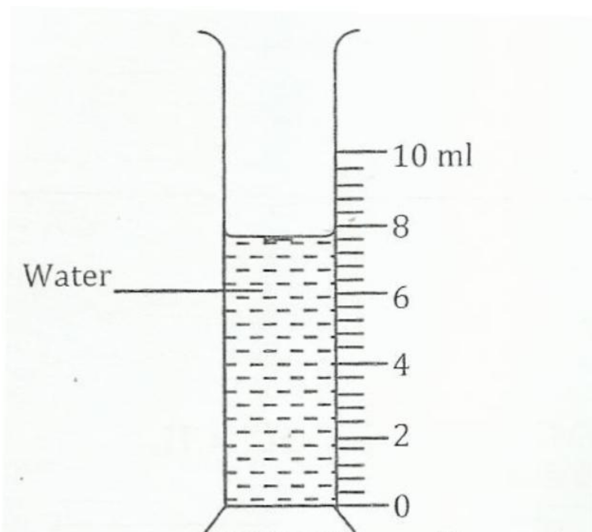

Figure 1

Determine the reading on the measuring cylinder, after three drops of water each of volume $0.6cm^3$ are added. (2 marks)

……………………………………………………………………………………………………

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……………………………………………………………………………………………………

2. A solid weighs 16.5 N on the surface of the moon. The force of gravity on the moon is 1.7 Nkg^{-1}. Determine the mass of the solid. (3 marks)

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………………………………………………

3. A bottle containing a smelling gas is opened at the front bench of a classroom. State the reason why the gas is detected throughout the room. (1 mark)

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4. Figure 2 shows a flat-bottomed flask containing some water. It is heated directly with a very hot flame.

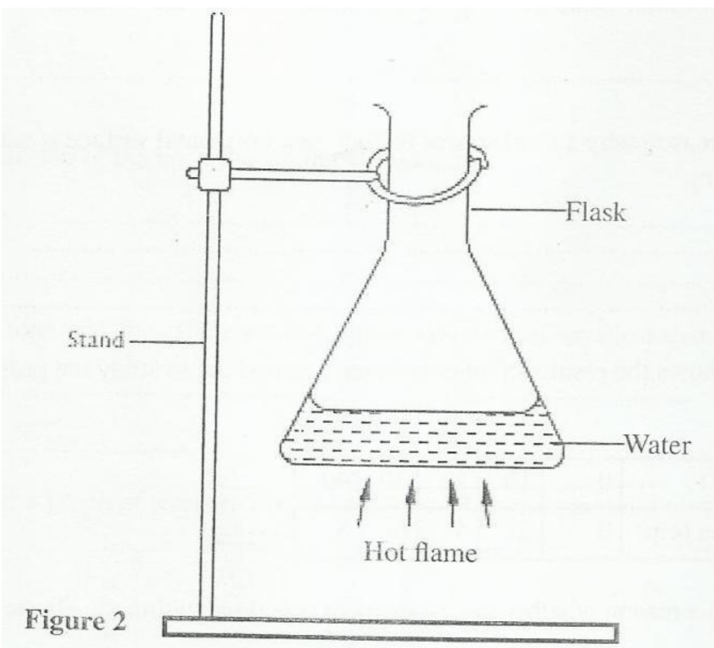

Figure 2

Explain why the flask is likely to crack (2 marks)

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5. State two environmental hazards that may occur when oil spills over a large surface area of the sea. (2 marks)

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6. State the reason why a steel sphere resting on a horizontal surface is said to be in neutral equilibrium. (1 mark)

……

……

……

7. Table 1 shows the results of an experiment carried out to study the properties of a spring.

Table 1

Force (N)	0	10	20	30	40
Extension (cm)	0	2	4	6	8

State with a reason whether the experiment was done within the elastic limit of the spring. (2 marks)

……

……

……

8. Figure 4 shows a graph of temperature against time when pure melting ice at 0^0C is heated uniformly.

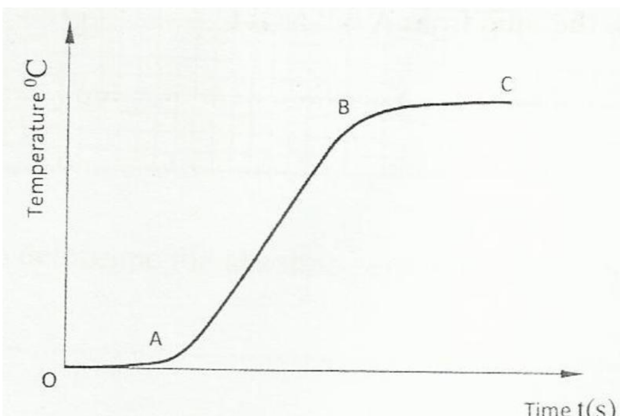

Figure 4

Explain what happens between parts:

(i) OA:……………………………………………………………………………(1 mark)

(ii) AB:……………………………………………………………………………(1 mark)

9. (a) An aeroplane is moving horizontally through still air at a uniform speed. It is observed that when the speed of the plane is increased, its height above the ground increases. State the reason for this observation. (1 mark)

…………………………………………………………………………………..…………

(b) Figure 5 shows parts A, B and C of a glass tube.

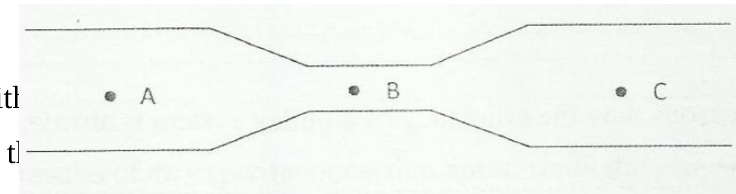

Figure 5

State witl be lowest when air is blown

through tl

(2

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10. In an experiment to demonstrate atmospheric pressure, a plastic bottle is partially filled with hot water and the bottle is then tightly corked. After some time the bottle starts to get deformed.

(i) State the purpose of the hot water (1 mark)

………

(ii) State the reason why the bottle gets deformed (1 mark)

…………………………………………………………………………….

(iii) Explain your answer in c (ii) (2 marks)

……………………………………………………………………………………..……

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11. A lift pump can lift water to a maximum height of 10 m. Determine the maximum height to which the pump can raise paraffin. (*take density of paraffin as 800km*$^{-3}$ *and density of water as 1000 kgm*$^{-3}$). (3 marks)

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CHEMISTRY

1. A mixture contains ammonium chloride, copper (II) oxide and sodium chloride.

Describe how each of the substances can be obtained from the mixture. (3 marks)

2. State two reasons why hydrogen.is not commonly used as a fuel. (2 marks)

3. Exhaust fumes of some cars contain carbon (II) oxide and other gases

a) Explain how carbon (II) oxide is formed in the internal combustion engines. (1 mark)

(b) Name **two** gases other than carbon (II) oxide that are contained in exhaust fumes and are pollutant (2 marks)

1 Distinguish between the terms deliquescent and efflorescent as used in chemistry. (2 marks)

5. Describe how the P^H of anti-acid (Actal) powder can be determined in the laboratory.(2 marks)

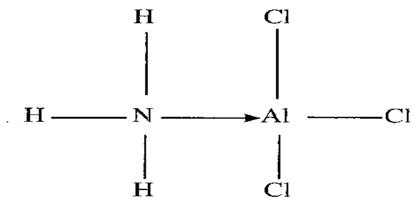
6. Graphite is one of the allotropes of carbon.

(a) Name **one** other element which exhibits allotropy. (1 mark)

(b) Explain why graphite is used in the making of pencil leads. (2 marks)

7. What name is given to elements which appear in group (II) of the periodic table? (1 mark)

8. The diagram below shows the bonding between aluminium chloride and ammonia.



(a) Name the types of bonds that exist in the molecule. (2 marks)

(b) How many electrons are used for bonding in the molecule? (1 mark)

9. The table below gives the number of electrons, protons and neutrons in substances X, Y and Z. Study it and answer the questions that follow.

Substance	Electrons	Protons	Neutrons
X	10	10	10
Y	10	8	10
z	8	8	8

(a) Which letter represents an ion? (1 mark)

(b) Which of the substances are isotopes? Give a reason. (2 marks)

10. The table below 'gives some properties of the fee elements in group (VII) Of the periodic table. Study it and answer the questions that follow:

Element	Atomic No.	Melting Point (°C)	Boiling Point (°C)
Chlorine	17	-101	-34.7'
Bromine	. 35.	-7	58.8
Iodine	53	114	184

(a) Which element is in liquid form at room temperature? Give a reason. (1 mark)

(a) Explain why the boiling point of iodine is much higher than that of chlorine. (2 marks)

MATHEMATICS

1. Without using a calculator, evaluate

$$\frac{1\frac{1}{5} - 1\frac{1}{3}}{\frac{1}{8} - (-\frac{1}{2})^2} - \frac{7}{15} \text{ of } 2$$

(4 Marks)

2. Find the reciprocal of 0.216 correct to 3 decimal places, hence evaluate

$$\frac{\sqrt[3]{0.512}}{0.216}$$

(3 marks)

3. Expand and simplify the expression $(2x^2 - 3y^2)2 + 12x^2y^3$ (2 marks)

4. Three bells ring at intervals of 9 minutes, 15 minutes and 21 minutes. The bells will next ring together at 11:00 pm. Find the time the bells had last rang together. (3 marks)

5. Koech left home to a shopping centre 12km away, running at 8 km/h. fifteen minutes later, Mutua left the same home and cycled to the shopping centre at 20km/h. calculate the distance to the shopping centre at which Mutua caught up with Koech. (3 marks)

6. Using a pair of compasses and ruler only, construct a quadrilateral ABCD in which AB = 4cm, BC = 6M, ad = 3cm, angle ABC = 135^0 and angle DBA =60^0. (4 marks)

7. Given that OA = 2i + 3j and OB = 3i – 2j (3 marks)
Find the magnitude of AB to one decimal place.

8. A line L passes through point (3,1) and is perpendicular to the line 2y = 4x + 5.
Determine the equation of line L. (3 marks)

BIOLOGY

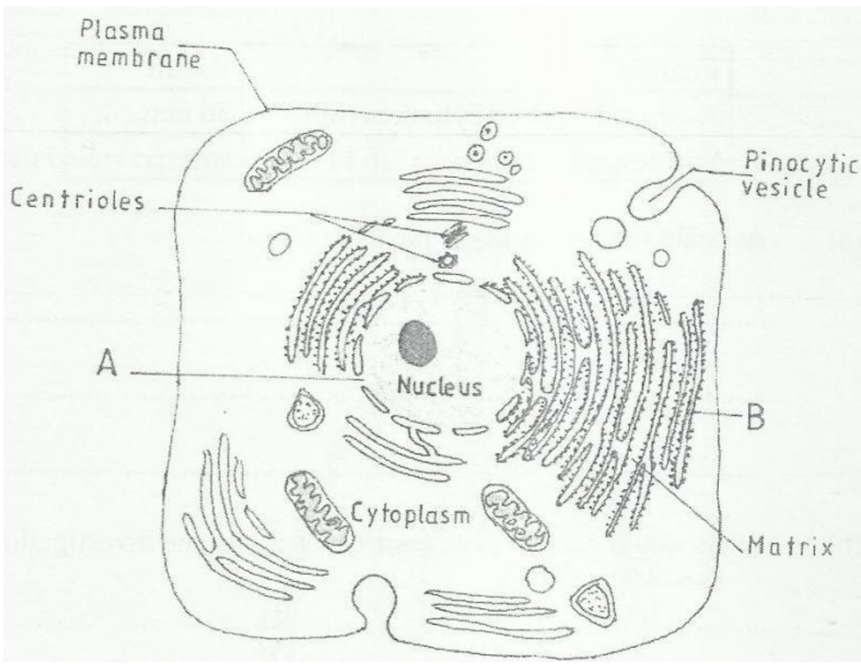
1. How does nutrition as a characteristic of living organisms differ in plants and animals? (2 marks)

____

____

____

2. The figure below is a fine structure of a generalized animal cell as seen under an electron microscope.



(a) Name the parts labeled A and B. (2 marks)

A ………………………………………………………………………

B ………………………………………………………………………

(b) How is the structure labeled B adapted to its function? (2 marks)

……………………………………………………………………………………………….

3. State three factors that affect the rate of diffusion. (3 marks)

…………………………………………………………………………………………

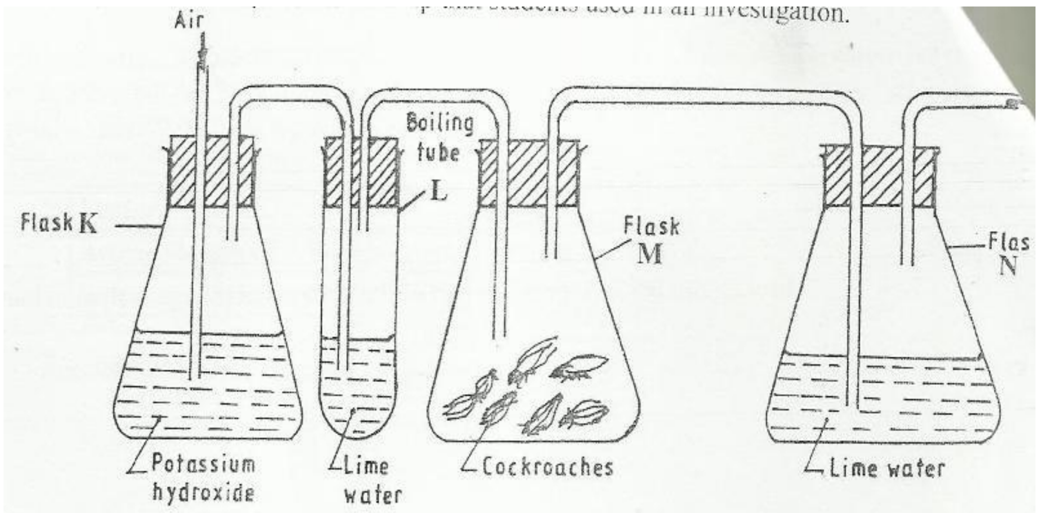
…………………………………………………………………………………………

…………………………………………………………………………………………………

4. (a) Name the part of light microscope used to bring an image of a specimen into sharp focus. (1 mark)

………………………………………………………………………………………

5. The diagram below represents a set-up that students used in an investigation.



(a) Name the physiological process that was being investigated. (1 mark)

………………………………………………………………………………

(b) State the role of potassium hydroxide in flask K. (2 marks)

L ……………………………………………………………………..

………………………………………………………………………

N ………………………………………………………………………

………………………………………………………………………

6. (a) Name the type of respiration that is most efficient (1 mark)

………………………………………………………………………………………

(b) Given a reason for your answer in (a) above (1 mark)

………………………………………………………………………………………

7. Name two substances that leave the foetal blood through the placenta (2 marks)

……………………………………………………………………………………

…………………………………………………………………………………..

8. Why are plants able to accumulate most of their waste products for long? (1 mark)

……………………………………………………………………………………….

9. What is the function of contractile vacuoles in amoeba? (1 mark)

………………………………………………………………………………………….

10. State two differences between open and closed circulatory systems (2 marks)

………………………………………………………………………………………….

………………………………………………………………………………………….

11. Name two nutrients that are absorbed without being digested by enzymes in humans. (2 marks)

………………………………………………………………………………………….

………………………………………………………………………………………….

12. Name the organelle that is involved in each of the following: (2 marks)

(b) manufacture of lipids ………………………………………………………….

(c) formation of lysosomes………………………………………………………….

FOR OFFICIAL USE ONLY

SCORE GRID

PHYSICS	CHEMISTRY	MATHEMATICS	BIOLOGY	TOTAL (100%)

APPENDIX G: FOCUS GROUP DISCUSSION GUIDE (FGDG)

Question guide for an Focus Group Discussion

School name: ____________________________________

School category: ____________________________________

Date: (DD/MM/YYYY) ____ / ____ / _______

Group name/description: ____________________________________

# of male participants: ______ # of female participants: ______

Ages represented in the group: ____________

Introduction: This focus group discussion is designed to assess your current thoughts and feelings about the science performance across gender. The discussion will focus on factors that influence science performance across gender and how to bring gender parity in science performance. This focus group discussion is important since its findings may be used to bridge the gender disparity witnessed in science performance to ensure woman are well represented in the STEM field. The focus group discussion will take no more than two hours.

Anonymity: Despite your comments being written down, I would like to assure you that the discussion will be anonymous.

Guiding questions

Question	Answer
1. Kindly reflect on the level of performance in science subjects among female and male students, what can you say about the difference in performance between the males and females	

2. Which science subject has the highest disparity in performance in terms of gender?	
3. What according to you contributes to this disparity in gender performance in science?	
4. Do you believe that the following factors influence science performance? a) gender stereotype in society b) Interest in science c) Science Self-efficacy	
5. If your answer to question 3 is, 'yes', how?	
6. How would the gender disparity in Science be solved?	

Conclusion

- Thank you for participating. This has been a very successful discussion. Your opinions will be a valuable asset to the study
- The results of the study will be availed to your school administration once the study is completed. In case of any information kindly contact me through your principal. Consequently, if there is anything you are unhappy with or wish to complain about, please contact me through the same office.

Thank you

APPENDIX H: HEAD OF SCIENCE INTERVIEW SCHEDULE

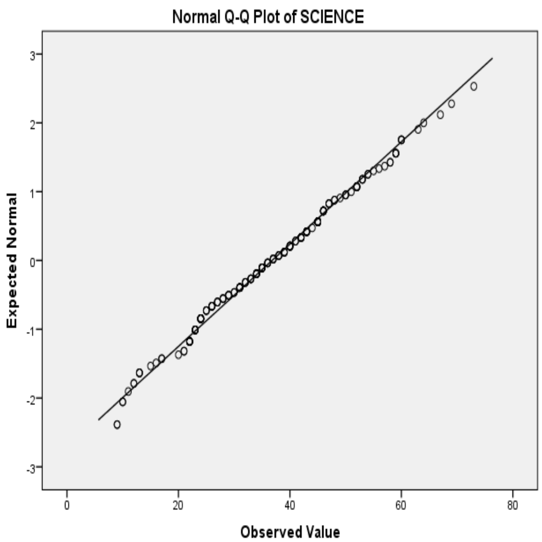
1. What do you think is the level of science performance across gender?
2. How do you think the following factors can contribute to gender disparity in science performance?
   a) Gender stereotype in society
   b) Self-efficacy in science
   c) Interest in science
3. Do you believe there is a gender disparity in science performance? If Yes, what according to you is responsible for this disparity in performance?
4. How do you believe teachers have contributed to gender disparity in science performance?
5. Can you suggest ways of creating gender parity in science performance?

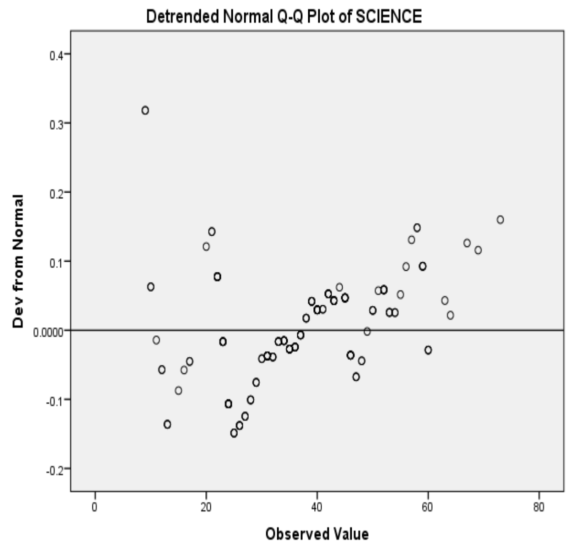
APPENDIX I: RESULTS FOR ASSUMPTION TESTING FOR MRA

Normality of the Dependent Variables

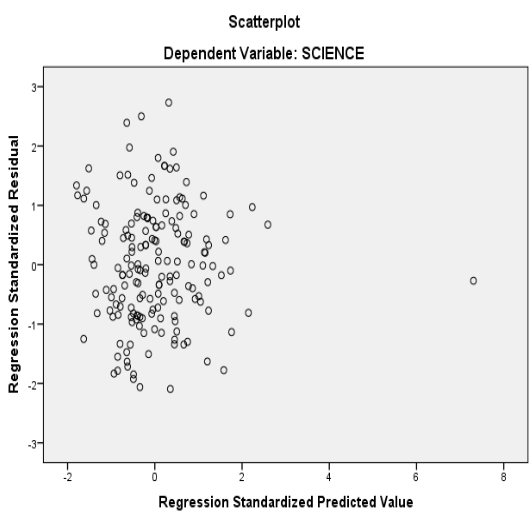
Test of Normality

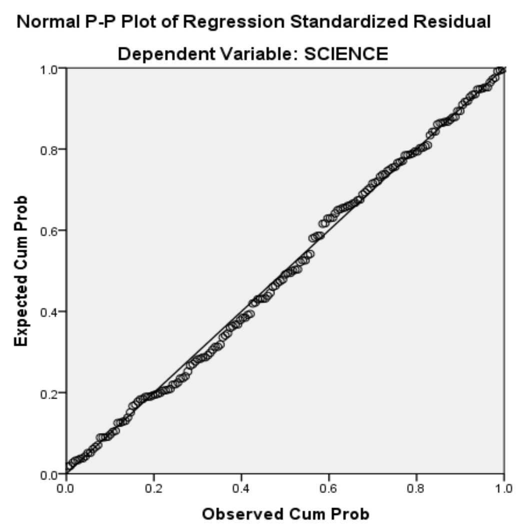
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Science performance	.052	175	.200*	.990	175	.237





Linearity





Multicollinearity of the Variables

Correlation Matrix

Variable		1	2	3	4	5
Pearson Correlation	Science performance	-				
	Self-Efficacy	.197	-			
	Gender Stereotype	-.178	-.033	-		
	Role Model	.109	.422	-.025	-	
	Interest	.253	.042	.028	.043	-
Sig. (1-tailed)	Science performance	.	.004	.009	.076	.000
	Self-Efficacy	.004	.	.332	.000	.292
	Gender Stereotype	.009	.332	.	.373	.354
	Role Model	.076	.000	.373	.	.286
	Interest	.000	.292	.354	.286	.

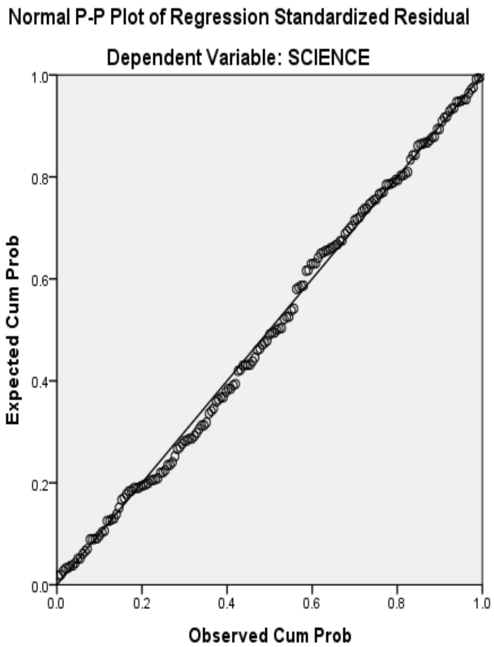
Collinearity Statistics

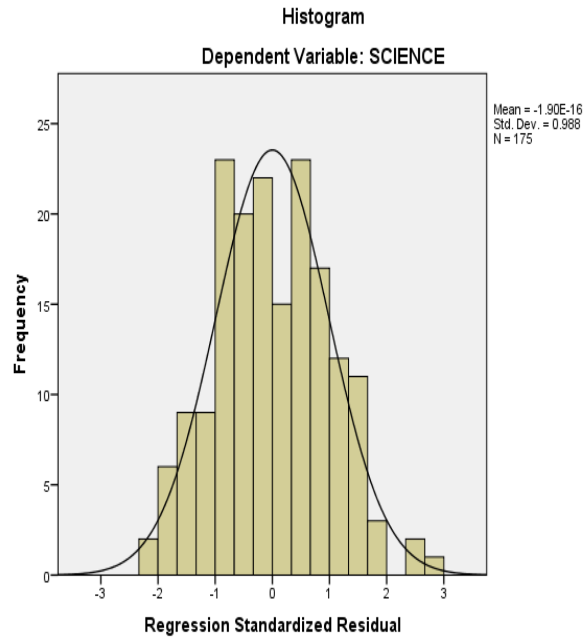
Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Self-Efficacy	.821	1.218
	Gender Stereotype	.998	1.002
	Role Model	.821	1.217
	Interest	.997	1.003

Collinearity Diagnostics

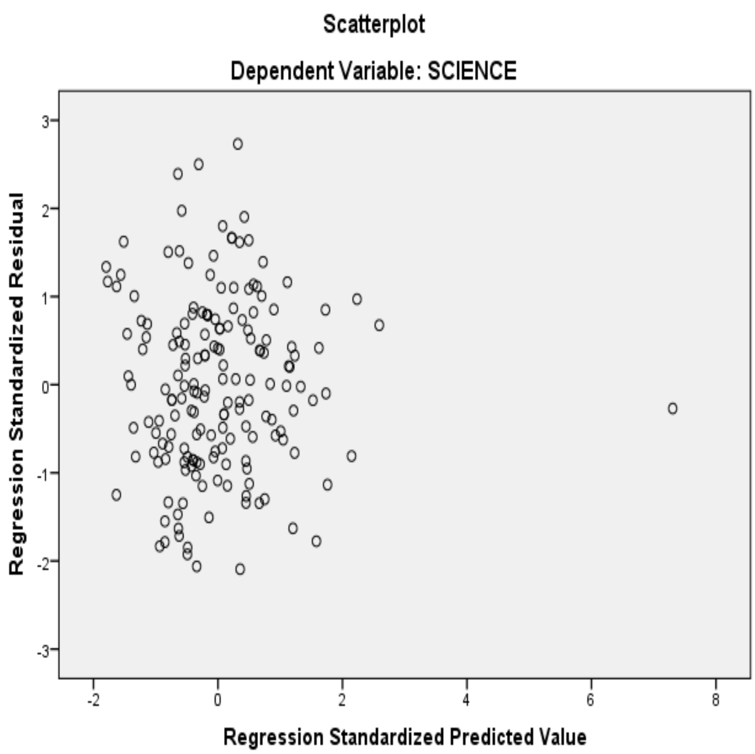
Model	Dimension	Eigenvalue	Condition Index	Variance Proportions				
				(Constant)	Self-Efficacy	Gender Stereotype	Role Model	Interest
1	1	4.855	1.000	.00	.00	.00	.00	.00
	2	.072	8.193	.00	.01	.84	.01	.11
	3	.049	9.904	.00	.05	.03	.08	.77
	4	.015	18.273	.04	.47	.01	.86	.02
	5	.009	23.262	.95	.47	.11	.04	.10

Normality of the Residuals





Homoscedasticity Test of Residuals



Presence of Outliers

Residuals Statistics

	Minimum	Maximum	Mean	Std. Deviation
Predicted Value	28.0506	72.4208	36.8057	4.87539
Std. Predicted Value	-1.796	7.305	.000	1.000
Standard Error of Predicted Value	1.040	11.185	1.942	.910
Adjusted Predicted Value	25.1287	84.4140	36.8461	5.47753
Residual	-26.53978	34.64080	.00000	12.53352
Std. Residual	-2.093	2.732	.000	.988
Stud. Residual	-2.113	2.786	-.001	1.001
Deleted Residual	-27.05174	36.03868	-.04037	12.90048
Stud. Deleted Residual	-2.135	2.844	.000	1.006
Mahal. Distance	.175	134.390	3.977	10.347
Cook's Distance	.000	.230	.006	.019
Centered Leverage Value	.001	.772	.023	.059

APPENDIX J: PROPOSAL APPROVAL BY SGS

MASENO UNIVERSITY

SCHOOL OF GRADUATE STUDIES

Office of the Dean

Our Ref: PHD/ED/00044/017

Private Bag, MASENO, KENYA
Tel:(057)351 22/351008/351011
FAX: 254-057-351153/351221
Email: sgs@maseno.ac.ke

Date: 23rd June, 2020

TO WHOM IT MAY CONCERN

RE: PROPOSAL APPROVAL FOR GOR POLYCARP OWINO — PHD/ED/00044 /2017

The above named is registered in the Doctor of Philosophy Programme in the School of Education, Maseno University. This is to confirm that his research proposal titled "Influence of Self-Efficacy, Interest, Role Model and Gender Stereotype on Science Performance: Gender as a Moderator among Secondary School Students in Migori County, Kenya." has been approved for conduct of research subject to obtaining all other permissions/clearances that may be required beforehand.

Prof. J.O. Agure
DEAN, SCHOOL OF GRADUATE STUDIES

DEAN SCHOOL OF GRADUATE STUDIES MASENO UNIVERSITY 03 JUL 2020 P.O. Box PRIVATE BAG, MASENO

Maseno University ***ISO 9001:2008 Certified***

APPENDIX K: AUTHORITY BY MUERC

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

REF: MSU/DRPI/MUERC/00865/20 Date: 7th September, 2020

TO: Gor Polycarp Owino
PHD/ED/00044/2017
Department of Educational Psychology
School of Education, Maseno University
P. O. Box, Private Bag, Maseno, Kenya

Dear Sir,

RE: Influence of Gender Related Factors on Science Performance among Secondary School Students in Migori County, Kenya

This is to inform you that **Maseno University Ethics Review Committee (MUERC)** has reviewed and approved your above research proposal. Your application approval number is MUERC/00865/20**.**The approval period is 7th September, 2020 – 6th September, 2021.

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by Maseno University Ethics Review Committee (MUERC).
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to Maseno University Ethics Review Committee (MUERC) within 24 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to Maseno University Ethics Review Committee (MUERC) within 24 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to Maseno University Ethics Review Committee (MUERC).

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE APPROVED 07 SEP 2020

Prof. Philip O. Owuor, PhD, FAAS, FKNAS
Chairman, MUERC

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED

APPENDIX L: NACOSTI RESEARCH PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 492652

Date of Issue: 02/October/2020

RESEARCH LICENSE

This is to Certify that Mr.. Polycarp Owino Gor of , has been licensed to conduct research in Migori on the topic: Influence of Gender Related Factors on Science Performance among Secondary School Students in Migori County, Kenya for the period ending : 02/October/2021.

License No: **NACOSTI/P/20/6921**

492652

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY &
INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document,
Scan the QR Code using QR scanner application.

APPENDIX M: MIGORI COUNTY MAP