GENDER AND SCIENCE

GIRLS LOW PARTICIPATION IN SCIENCE: A COMPARATIVE STUDY OF FOUR SELECTED SENIOR HIGH SCHOOLS IN GREATER ACCRA REGION, GHANA.

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Gender and Science: Girls Low Participation in Science

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ABSTRACT

The low participation of girls in the study of science is still a reality at the senior high schools in Ghana.Inspite of several interventions from women groups government and other development partners, the phenonmenon still prevails and seem not to go, notable among such interventions is science technology and mathematics education(STME) clinic for girls from 1987 to date. In view of that, this study attempts to explore and investigate with the focus on the school culture why the phenomenon still persist at the senior highschools which are the pipeline leading to careers in the field of science and technology.

Data for the study was collected by adopting qualitative methods like interviews, classroom observations and document for data collection. The qualitative approach was adopted to give the participants the opportunity to freely express their views and lived experiences in the school within the constructivist perspectives.The data obtained were mainly sampled from students and teachers from four mixed schools made up of two goverment assisted(mission) schools and two public schoolsin the Greater Accra region of Ghana.

The data collected have been categorised into five main theme:the policy and school prohibitive rules, the teachers attitudes, the teachers teaching style,schools facilities and the relevance of science.The emerging findings within the categorised themes analysed qualitatively.On policy and school prohibitive rules data obtained from public and government assisted school revealed that the computer placement system of selecting students into programme displaces students from their chosen programme and contribute to some extent the low participation of girls in science. Also from the schools, the existence of certain school rules works against girls and especially affect the performance of girls in science consequently discouraging them from taking up science programmes.

On the issue of teachers attitudes all participant from the selected schools confirmed that with a few exceptions teachers negative attitude during classroom interactions contributes immensely to the low participation of girls in science at the senior high school. Teachers taeching style the third theme in terms of teaching method were also mentioned as a major contributing factor within the school that is contributing to the persistent low participation of girls in science. It was mentioned that most science less were abstract, does not take into account the socio cultural context of the student, different cognitive style of learning and

lacks hand – on experience learning which is found to be suitable for girls in science(Cooper and McIntyre, 1996; Woolnough 1994).

School facilities such as specimen at the science laboratory, computers, projectors were also mentioned as accounting for the poor teaching style of teachers and their inability to vary their teaching method to suit the cognitive style of learning by the girls. This from all the school affect all students but girls are mentioned as the most affected because they most often cannot not cope with the extreme abstract teaching style. Lack of the neccessary specimens in labs also contribute to poor performances of girls which intend affect their particpation.On the last theme the relevance of science all participant from the four schhols acknowledeg the relevance of science to the individual girls and the society at large and the need for all the genders to be fully representated in sciences but the data revealed that their participation rate is lower than the boys.

I conclusively argue that policy and schools prohibitive rules and lack of or inadequate teaching learning materials(facilities) that will meet the learning needs of girls are the key faactors within the domain of the school enviroment contributing to girls' low partcipation in sciences. Teachers beliefs and attitudes and teaching style have also been identified as other elements within the school culture with the classroom as school micro culture((Fengshu,2006) are elements within the school that present science as male domain and tend to segregate and discrimniate against girls low participation in science.

Finally, I recommend an attitudinal change, right from the society itself where these negative attitudes emerged to the school. This can be possible through education by the use of electronic and print media on the rights and benefits of girls in science. This must start from parents ,chiefs and opinion leaders in scociety, then teachers who are also members of the society. This will change the beliefs and perceptions for girls in science. The leadership of the schools must also be critically examined, the schools need innovative, self motivating and socially connected leaders at the senior high school who are willing to share and learn form others. The STME clinic which gives fifty percent quota participation for boys and girls need to be revised to give more room for girls until parity is achieved.The STME clinic must start from primary four under the slogan ''catch them young''.

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Joyce Rhoda Akuaku

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ACRONYMS

AAUM	American Association of University Women
AMA	Accra Metropolitan Assembly
APA	American Psychology Association
BECE	Basic Education Certificate Examination
CAMFED	Campaign for Female Education
GDP	Gross Domestic Product
GES	Ghana Education Service
GEU	Girls Education Unit
GSS	Ghana Statistical Service

JHS	Junior High School
KNUST	Kwame Nkrumah University of Science and Technology
MDG	Millennium Development Goal
MOE	Ministry of Education
NPA	National Plan for Action
SHS	Senior High School
STEM	Science Technology Engineering and Mathematics
STME	Science Technology Mathematics Education
UNESCO	United Nations Educational Scientific and Cultural Organisation
WAEC	West Africa Examination Council
WASSCE	West Africa Senior Secondary Certificate Examination

1 CHAPTER ONE: BACKGROUND

1.1 Introduction

The chapter describes the research context, research problem, and objectives of the study with research questions, purpose, the significance of the study and personal motivation for the study. The chapter additionally presents the historical and geographical background of Ghana the country understudy, education system of Ghana with focus on the senior high school, girls and science education and limitations of the study the chapter concludes with a description of the organisation of the thesis.

1.2 Background

It is an acceptable fact over the entire world that no nation can progress without embracing scientific education. Education is vital for the development of the human resources necessary for harnessing the natural resources for economic and social development. Indeed, there can be no meaningful development of a nation without emphasis on education (Kwapong, 1995; Anamuah-Mensah, 2000). It is estimated that just an increase in one year in the average years of education could possibly lead to a 3% increase in Gross National Development (World Bank, 1990). This is because education is critical to the development of the manpower of a nation. Therefore the greatest need of a country's socio-economic development is the right type of manpower attained through education and not just the availability of natural resources (Addae-Mensah, 2000; Babaci-Wilhite and Geo-JaJa, 2011). It is not just education in the broadest sense but particularly science, technology and mathematics education is seen as the most important pre-essential condition necessary for spearheading development and transformation of the national economy of any country.

Science is regarded as the cornerstone of industrial development and the link between technology and socioeconomic development. Ekine and Abay (2013) imputed that a country's ability to secure good health, fight diseases, protect the environment, produce food for its citizenry and develop new industries and technologies is dependent on the scientific knowledge and skills of its people. Access to scientific knowledge is needed to enhance a country's competitiveness in the global economy. It is therefore very important that both men

and women to participate in the development of science as both genders bring diversity and strength to the generation of scientific knowledge.

However, despite efforts made to promote girls in science education over the past three decades, there is worldwide under-representation of female population in science courses, specifically high school, college and university science programmes and majors, and many scientific careers. Women are significantly underrepresented in every sector of Science, Technology, Engineering and Mathematics (STEM). Men outnumber women as students, educators, researchers, and workers in these fields (Ibrahim, 2014; UNESCO, 2010). Available data from UNESCO indicates that in 121 countries women make up only 29 percent of science researchers (UNESCO Institute of Statistics, 2012). However, the low participation, performance and career choice varies across the regions of the world (Sinnes, 2005). For instance women represent 31% of European science and engineering undergraduates (European Commission 2003 cited in Sinnes, 2005)39% of undergraduates in the US (National Science Foundation, 2009) 20% of undergraduates in information technology and the sciences in new Zealand 34% in Scotland (Croxford, 2002) and 18% of computer science and 11% of software and engineering in the United Kingdom (Selby (1997). The low participation is stronger in the developing countries particularly in Sub-Saharan Africa. In the developing countries it is estimated that the developing regions need 200 scientists per million individuals for its effective industrial development needed to alleviate poverty (UNESCO, 2000).Ghana is in need of 12,000 engineers and 48,000 technicians for science and technology to take off (UNESCO 2010;Ghana Statistical Service, 2012).

The under-representation of females in scientific studies has stimulated widespread concern from multilateral organizations like the UN agencies, national governments, industry and academia in developed and developing countries calling for solutions and what can be done to reverse the trend. The former UNESCO Director Koichiro Matsuura described the low representation of women in science as unacceptable in various spheres of societal life:

> It is economically unacceptable because of the waste of human resources that it entails; it is humanly unacceptable since it prevents half the population from taking part in building the world; it is intellectually unacceptable as it deprives scientific and technological research of ideas and methods, in a word, of creativity. Furthermore, it mortgages the future since it nullifies any prospect of a general mobilization in support of science in the service of a lasting peace and sustainable development (Ekine and Abay, 2013, p. 1).

Researchers on the need to increase the participation of girls in science have put a myriad of argument forward. Firstly, there is a need for more and better-trained scientists to secure the nation's future prosperity, and female students are an asset yet, under-utilized resource (National Academy of Science, 2006). Demographically, females make up half of the talent pool from which to draw students to physics, yet they represent an insignificant proportion of students who choose to pursue careers in the physical science. Further, diverse groups are more productive and successful than uniform groups, and females can potentially bring new perspectives to physical science (Schiebinger, 1999; Kenway and Gough, 1998).

Lastly, degrees in the STEM fields lead to more lucrative and prestigious career opportunities. Females should have the same opportunities to earn a degree in STEM fields and pursue those careers as males, but research shows that they currently do not (National Academy of Science, 2006). The lack of female participation in mainstream science and technology disciplines means that many countries currently realize only a portion of their potential in these areas (Mbirianjau, 2009). For girls and women to have their place in the job market, they need to have right and equal access to education, training, in science and technology to empower them in the context of global economic and technological changes to promote sustainable development in their communities.

At the 1990 World Conference on Education for All in Jomtien, Thailand, world leaders declared female education not only as a fundamental right, but also as an important means for economic and social development (UNESCO, 2003). Also, the Millennium Development Goals 2 and 3 underscore the importance of ensuring equal access to education for boys and girls, eliminating gender disparities in primary and secondary education, developing non-discriminatory education programs and curricula, and allocating sufficient resources for monitoring and implementing equitable education reforms (UNESCO, 2003; United Nations Millennium Declaration, 2000 cited in Bamora, 2010).

In view of the great importance of science education, Ghana has sought to increase, sustain the interest of students especially girls who are lagging behind at the secondary and tertiary levels of education. The Government of Ghana has made considerable public investment and sought external support directed towards attracting and increasing the proportion of girls studying science at secondary and tertiary levels. For instance as part of the 1987 educational reform, the Government of Ghana in collaboration with UNESCO initiated the Science,

Technology and Mathematics Education (STME) clinic which will be elaborated in the subsequent section. Yet studies have shown that gender equality in science education is still very far from being a reality at the secondary school level, where girls' enrolment, completion and achievement rates are lower at all levels of education, especially their performance in subjects such as mathematics and science (Evans, 1995; Odaga, 1995; World Bank, 1996).

It must be emphasized that in the current globally competitive 21st century where technological knowledge is transforming societies and lives, the engagement female population in science education and their involvement in the development of technological products can no longer be ignored or left to be marginal. As a developing country, Ghana cannot afford the luxury of under-utilizing the brainpower, and talent pool of both sexes in the drive towards scientific advancement and innovation. In the end the emancipation of women is inextricably linked with their education and in fact their freedom could be said to be the function of their level of participation in science education (Dimbisso, 2009).

To increase the numbers of females participating in STEM fields in Ghana, it is important to first delineate and understand the factors that influence girls to or not to study science and mathematics. An important step in the study of science and mathematics for Ghanaian girls is elective science course at the senior high school, which is the foundation for future tertiary studies of STEM subjects and careers in STEM fields. Understanding the factors that promote or discourage the study of science at this level of education is very important to understanding the underrepresentation of females in science and mathematics and findings ways to eliminate them.

1.3 Statement of the Problem

Several factors have been identified as responsible for the low participation of girls in science and mathematics education. These factors include discrimination (Straus, 2002), societal values and norms (Aguele, 2004), religious, psychological, attitudinal and interest levels of student (Brotman and Moore, 2008; Chang, 2002; Osborne, Simson and Collins, 2003).Again, Daddieh(2003) observed from the African context in addition to these factors found financial difficulties associated with girls education. The main focus of this study however, is to examine the influence of school culture on the participation of girls in science at the senior high school. It has been observed that schools play a crucial role in fostering students' motivation to learn (Freire 2005; Kimmel, 2000; Woolnough, 1994), and therefore likely to

influence girls' motivation for science and mathematics. Schools provide the learning environment that is crucial to the performance and survival of students at any given level.

In Ghana all pupils are made to study integrated science (general science) and mathematics at the basic school level. However at the senior high school they have the option to choose to study science[1] subjects for three years as an elective programme. Success in the study of science at the senior high school is used to select students to study science at the various universities in Ghana. However, girls lag behind boys in enrolment and achievement in science and mathematics at the senior high schools in Ghana and consequently grossly underrepresented in STEM fields at the tertiary institutions in Ghana. Unfortunately not much is known about the effect of schools culture on girls' motivation and participation in science in Ghana. This study examines the school level context that influences the participation of girls in science and mathematics. The main focus of this study is to investigate how the pedagogy, the organization and structure of the school and its environment influences the participation of girls in science programmes at the senior high school level. The study would look at the characteristics of the school with regards to teaching style of teachers; the relationship between teachers and students among others and their effects on the participation of girls in science and mathematics studies.

The objectives of this study are as follows:

1.4 Objectives

1. To examine how the availability of school facilities influence the participation of girls in science programmes in senior high schools.
2. To explore the effect of teachers teaching style on the participation of girls in science
3. To examine the effect of teachers attitudes on girls low participation in science programmes.
4. To understand the role school policies play in the low participation of girls in science programmes.

[1]Science in this context is referred to as the elective programme offered in the senior high school which consist of subjects such as biology , physics , chemistry, mathematic, agricultural science, geography and computer science.

1.5 Research Question

1 How do institutional factors affect girls' participation in science?

*How does the availability of school facilities (e.g. science laboratory equipment and textbooks) influence the participation of girls in science?

*How does school policy and rules affect girls' participation in science?

2. How do individual factors affect the participation of girls' in science?

*How does the teacher's attitude influence the participation of girls in science?

*What are the effects of teacher's teaching style influence on girls' participation in science?

1.6 Purpose of the Study

Schools have a very determining influence on the student interest and study of subjects since they are the transmitters of knowledge. The purpose of this study is to examine the reasons for the low participation of girls in science at the senior high school in Ghana. The focus is on getting a deeper understanding of the factors at school level and how they influence the participation and performance of girls. This will be done by looking at the experiences of girls in their participation in science programmes at the senior high schools in Ghana.

The study is intended to serve as a guide to the educational planners, policy makers and school authorities to make sound and viable policies and vibrant workshops and to encourage girls' participation in science.

Once a better appreciation of the school culture (factors within the school) underlying the poor participation of girls in science programmes is grasped, possible solutions can be devised to address them. Also the necessary remedial actions and steps at classroom level, school, community and national levels can be taken to effectively combat the root causes of the gender inequality in science education. Identifying factors at the school levels that perpetuate the low participation of girls in science can lead to incorporation of gender sensitive policies in the training of teachers, improvement of school facilities, restructuring of the science curricula, academic programmes and pedagogical style, changing of the attitudes of teachers and creating of a favourable and conducive school environment fit for the study of science by girls at all levels of education.

1.7. Significance of the Study

Over the past two decades, Ghana have made substantial investment into the education of girls especially in the area of improving access to and retention of girls in science programmes at the senior high school and tertiary education. However, the gender parity in science education has not been achieved.

The trend of gender inequality in school is worrying since Ghana is in urgent need of scientist to spearhead her development in the 21st century and make her globally competitive. This calls for urgent need for a study to investigate the underlying causes of the low participation of girls in the study of science.

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It is also pertinent that research is conducted to see how best the issue of the continuous underrepresentation of females can be dealt with so that more female scientists can be produced as role models for the future generation. The relevance of this study lies in the fact that the outcome will show the role that school type, teacher's attitude, teacher's gender and teaching style play in the participation and performance of girls in science and mathematics.

It is hope that the outcome of this study will contribute greatly in improving the teaching and learning of science and mathematics at the basic and secondary levels of education in Ghana. This will eventually lead to an increasing number of girls studying science and mathematics at the secondary and tertiary levels of education where these subjects are optional. The long-term effect of this is the increase in the number of technical expects needed to spearhead the technological advancement of Ghana.

The study will also compliment the effort being made by the Government of Ghana and some non-governmental organizations in improving girl's enrolment, retention and performance in schools at all levels especially in the area of the study of science and mathematics which are critical tools for national economic development and acceleration. Lastly this study will contribute to the existing body of knowledge on gender and science.

My personal motivation

Women in Ghana over the years have contributed immensely to the development of the nation to bring it to its present status as a middle income country and politically stable. Their role in society cuts across all aspects of the social structures. Politically they are the king makers as they raise and groom young men to take kingship positions and this is clearly evident in the middle belt of the country; the Ashanti region to be specific (see appendix 2) on the map of Ghana to see the location of this region. They also play various religious roles alongside their male counterparts. Again, Ghanaian women wield so much economic power as they are engaged informal and formal economic activities. For instance distinguished women such as the late Mrs Esther Klu who was an industrialist and the first in Ghana to process and canned palm fruit for exportation to various parts of the world, the late Theodosia Okoh also single handed designed the national flag and the former first lady Nana Konadu Agyemang Rawlings who established the 31st December daycare centres throughout the country which later set the stage for early childhood development centres. Most of these women have also distinguished themselves in the academia and notable among them is the late Professor Awurama Addy who headed the physics department at the University of Ghana for years. This is not to undermine the role of the Ghanaian men but the time has come for the effort of the Ghanaian women to be acknowledged, appreciated and to be given space in the contemporary science and technological environment to broaden their horizon. In the region where I was born and raised most of the women are the breadwinners and bread processors in their nuclear and extended families, a role they play effectively to the admiration of their children without complaining.

Again, from the informal sector through their economic activities, they also engage in scientific activities, such as brewing of locally brewed beer (pito) and extraction of Shea butter at the northern regions, fish processing and preservation among the coastal women palm and kennel oil extraction and soap making in the middle belts. They are also involved in traditional herbal medicines, which over the years have contributed immensely to the healthcare needs of the country. Some studies contended that girl's low participation in science and its related fields can be attributed to a disjoint between experience and understanding. For instance Kahle (2004) posited that girls' negative attitude leading to low participation in science is due to their lack of experiences and understanding in basic scientific knowledge. Similarly, Johnson (1987) also mentioned that lack of and differences in childhood experiences between boys and girls show the differences in their participation rate.

This is in contrast to what happens in Africa in general and specifically in the Ghanaian context. As a growing girl and many others in generation and in the present generation have inherited some of this scientific knowledge from our parent and grandparents even before our formal education but at school we could not find the connection between what is done at home and at the school as most are considered crude and unscientific. Instead the school science presented was more of a field for men and not women denying most girls the right in participating in formal classroom science. As Freire (2005) and Babaci-Wilhite (2014) noted that there is a disjuncture between learners' experiences and what is experienced at school. This is what is happens most of the time at school as science is not based on the context of the girls. Findings from Education strategic plan on policy, target and strategies review on science and technology revealed that science is poorly handled in Ghanaian schools(Education strategic plan, 2003) My point here is if the Ghanaian women are already in the lead just as their counterpart in the western countries like Norway and Sweden their girls who already have so much of such knowledge and experiences through socialization from the home when given the necessary support at the school to participate in science have the potentials of transforming the economic conditions of the country and also promoting their own well-being.

1.8 Historical and Geographical Background of Ghana

Ghana the gateway to Africa attained independence in 1957.Geographically, the nation is located the West Africa Gulf of Guinea few degrees north of the equator. French speaking countries surround the nation with Burkina Faso to the north, La Cote d'Ivoire on the west and Togo to the east. (See appendix 2 for Ghana map) The nation is endowed with a good education system which date back to the colonial era and between 1950s and 1960s her education system was the icon within the Sub- Saharan Africa (Little, 2010). Ghana is politically a democratic nation and has since her return to constitutional rule in 1992 remain stable and constantly ranked third for press freedom and freedom of speech making the land a safe haven for refugees from the neighbouring countries within the sub region (World Bank, 2014). Again, the nation is religiously pluralistic and people are free to join any religious group they so wish without fear and intimidation. According to a World Bank report Ghana has attained a middle income status amidst economic instabilities with gross domestic product growth rate (GDP) of 7.6 percent at the end of the 2013 fiscal year(ibid).

The nation with a population of 25.9 million people is endowed with a relatively young and healthy population, with 11.7 million people as its work force this makes dependency ratio of the nation very high (World Bank, 2014; Ghana Statistical Service, 2010).According to the 2010 population census report the female population outnumber the male indicating that pragmatic steps need to be taken to include women and girls in all spheres of life. Ghana has long believed in the education of women as this was captured in the words of one lustrous son of the land the late Dr Aggrey who was an educationist during the colonial era. He said'' if you educate a man you educate an individual but if educate a woman you educate a nation''. This has led several governments over the years to make the education of women a national priority.

1.9 Ghana's education system

Ghana's education system after independence has undergone several reforms to wean it from purely academic system handed over by the British to one that will serve the manpower needs of the nations. Notable among them were the reforms in the 1980s that change the structure of education from seventeen to sixteen years. The structure and content of education from 1987 has led to significant reduction in the number of years of pre-tertiary education from seventeen (17) years to sixteen (16) years with two years of early childhood schooling.

The present structure of education start with six years made up of six years primary education, three years junior high school, three years senior high school and four years of tertiary (university and polytechnic) education. Students who graduate successfully form high school enter either the university or polytechnic. Others also enter diploma awarding institutions such the teacher education or nursing institutions for three years (GES, 2003)

Basic education in Ghana is made up of a free and compulsory primary and junior high school which is designed to expose all learners to a wide range of skills and knowledge that will inculcate in them creative abilities that will help them harness resources in the environment for their well-being and that of the society. Therefore the primary school curriculum is geared towards work and consist of subjects such as English Language, Ghanaian Language and Culture, Mathematics, Environmental studies, Integrated Science, Religious and Moral Education with physical activities such as Music and Dance and Physical Education. At the junior high level of the basic education a clear demarcation is made between Agricultural and

General Science with additional subjects like Social Studies, Vocational Skills and Pre-Technical Skills and French as a third language(ibid)

In conclusion the basic and senior high schools run a forty week academic year and students are examined using the continuous assessment of thirty (30) percent of final score and an external examination conducted by the West Africa Examination Council which forms seventy percent of the final score (GES, 2003).The senior high school (SHS) is the focus of this study and so the next section will present a highlight on SHS programme.

Senior High School Programme

The senior high school in Ghana has suffered in terms of number of years of completion from 1999 to 2007 moving between four and three year from many reforms but currently stationed at three years. The three years' post basic education provides students with variety of aptitudes; abilities, interest, knowledge and skills to further pursue academic, technical and vocational education.

Curriculum of senior high school consists of core and elective subjects. Core subjects are made up of English Language, Mathematics, Integrated Science (elements of science, agricultural science and environmental studies) and Social Studies. The elective subjects vary from programme to programme, the curriculum is again structured into five main programmes namely: General Arts, Business, Science (with Agricultural Science), Home Economics and Visual Arts. Presently students have the right to choose from the five programmes however the computer placement selection system finally decides which one should pursue. Placement into any programme is based on performance at the Basic Education Certificate Examination (BECE) at the end of junior high school. A Science programme in Ghana consists of subjects such as biology, physics, chemistry, computer science, geography and agricultural science. These form elective subjects for the science programme and are combined with the core subjects for the science students. Students are however allowed to do the entire elective science programme but this also largely depends on the school and the programmes available. Students who desire to take up science programmes need to score ones in all subject sat at the BECE examinations. A good raw score is needed to be enrolled in a grade 'A' school which also poses a challenge for most students across the country.

1.10 Girls and science 'education in Ghana

Education of women and girls has been the concern of various governments on lack of persistent equality in the participation and achievement of girls in education. Currently the country is one of the West Africa countries that have made meaningful progress towards increasing access to education and bridging the gender gaps in enrolment. The idea of national vision for girls' education was born in December 1995 after Ghana's participation in the Beijing Conference. This led to the drawing of National Plan of Action (NPA) which led to the establishment of Girls' Education Unit (GEU) with the goal of ensuring equity in education of boys and girls in terms of access, participation, retention and achievement with a special emphasis on increasing transition of girls from junior high school to senior high and their participation science, technology, engineering and mathematics (STEM) (MoE, 2003; MoW CA, 2004).

In order to achieve the set goal in the action plan, several strategies have been put in place by the government of Ghana her development partners and notable among them are the school feeding programme, free uniforms and abolishment of school fees at the basic level of education. A renewed commitment towards achieving parity in science education was reechoed in the policy goals one and ten of the Education Strategic Plan aimed at providing girls equal opportunity to participate at all levels of education(M o E, 2003). The government through the ministry of education in collaboration with Campaign for Female Education (Camfed), UNESCO and World Vision established and implemented science, technology and mathematics education (STME)clinic for girls at the junior and senior high schools in Ghana in 198(ibid).

Science Clinic

The term clinic is given to the science technology and mathematics education (STME) workshop organized annually for all students at the junior and senior high schools Ghana. It is aimed at diagnosing and possibly prescribing a therapy for the existing low participation of girls in science education (MoE, 1995). Also known as the summer school, it is organised mostly during the third term vacation (summer holidays) at its inception for girls from all over the country. The girls are made to interact with female scientists (role models) at a workshop

for two weeks exposing them to the prospects in the field and demystifying science for the girls'

Also the girls are taken to other places like tertiary institutions of science and technology, science research centres and industries to acquaint themselves with the opportunities awaiting them as they embark on the field of science. Recently as studies have begun to question the focus on girls and asking for balance in opportunities for girls and boys in education (Fengshu, 2006; Skelton, 2001), as result the STME clinic is current organized for male and female students across the country.

Objectives of STME clinic

The SMTE clinic is organised with several objectives. In general, it is aimed at creating awareness of gender stereotypes that militate against girl in science technology engineering and mathematics based fields and how they can be overcome. Again, as there are beliefs that females who pursue sciences cannot have successful marital lives (Anamuah-Mensah, 2000; Murkerhirn, 1966), through the workshops participants are taken through counseling from the female role models to correct such erroneous assumption.

It also serves as a platform to provide opportunities for participants to improve upon their skills as schools learn from each other through problem solving activities. Specifically, STME programme is meant to decrease the possibilities of girls accepting gender stereotypes that influence their participation in science at school and consequently their participation in scientific field (DEG, 2008; GES, GEU, 1997).

Science and technology education pedagogy

According to Education strategic plan on policy, target and strategies review, science and technology education in Ghana have not improved in terms teaching and learning instruction. The improper handling of science and technology education has been attributed to lack of or inadequate facilities such as science laboratory, laboratory equipments and relevant specimens for the teaching of the sciences at most schools in Ghana. Addae-Mensah (2000) in agreement with the assertion mentioned that only 18 out of 504 senior high schools in Ghana are well equipped with the necessary facilities and qualified teacher for the implementation of effective teaching of science programmes at the senior high schools to feed the tertiary institutions.

The poor teaching of science have affected performance at the national certificate examinations. According to the statistics, girls' are mostly affected as the 2013 Education strategic report on national performance indicate the poor performance of students in science from 2006 to 2012**(**Education Strategic Plan, 2013).

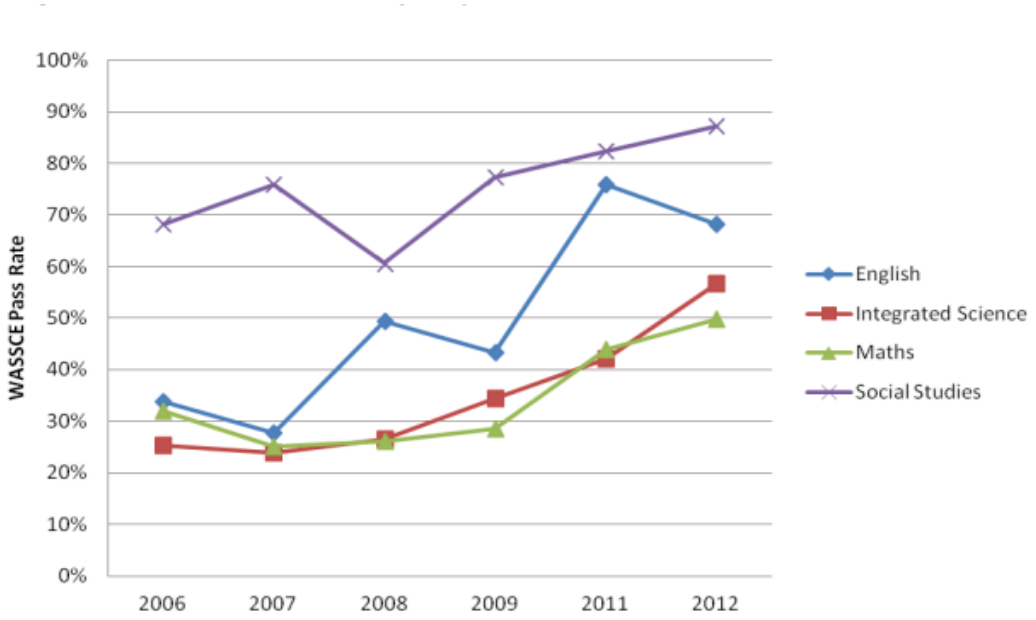

Figure 1WASSCE Examination pass rate by subject

Data source: Education Sector Performance Report (Ministry of Education, 2013**).**

The chart above shows that the poor teaching of science at the senior high schools have affected student performance at the national examination certificate examinations in 2013 report. Education strategic report on national performance in the West Africa Secondary Schools Examinations indicated that the poor teaching of science has affected performance of students in science compared to the other three core subjects from 2006 to 2012**(**Education Strategic Plan, 2013).

Table 1 WASSCE Examination pass rate in core subjects

	Male pass rate	Female pass rate	Total pass rate
English	69%	67%	68%
Mathematics	55%	44%	50%
Integrated Science	61%	52%	57%
Social Studies	88%	86%	87%

WASSCE Examination pass rate by gender, 2012
Data source: Education Sector Performance Report (Ministry of Education, 2013)

Table one above also shows students' performance in percentage by gender in the four core subjects' area .From the table; girls are the most affected by the poor teaching of science as they are lagging behind the boys in terms of performance. Atuahene and Owusu-Ansah (2013)mentioned that this has led to disparity in enrolments between students by gender at the university even though at the university the cutoff grade point for females are lower than males. Owing to number of challenges associated with science education, The Ministry of education and its sub-sectors have called for further probe into the incident to adopt policies, goals and strategies to help curb the phenomenon and to provide girls with equal opportunities to participate at all levels of education(Education strategic plan,2013).

1.11 Limitations of the study

The study could have been carried out in all the senior high schools in the Greater Accra Municipality in Accra. However, this was not feasible due to time and financial constrains the study concentrated on only four selected senior high school in Ga East and West districts of the region. As a result the study may not be applicable to all schools in Ghana. However, findings can still give an indication of what is pertaining in other senior high schools in Ghana.

1.12 Organisation of the Thesis

The thesis is organised into five main chapters as follows. The first chapter presents an introduction to the study, background, the problem statement, objectives of the research, research questions, purpose of the study significance, personal motivation, historical and geographical background of Ghana, education system, girls and science education and lastly limitations of the study.

The second chapter features the review of literature and the theoretical framework of the study. Here relevant literature pertaining to the participation of girls and females in science and mathematics are reviewed from different contexts. The literature review is organised into themes that are relevant to this study. These themes include female participation in science and mathematics, school environment and girls' participation in science, teacher attitudes and girls' participation in science, school type and girls' participation in science. The second section of this chapter presents the theoretical framework of the study.

The third chapter outlines the research methods and procedures of data collection to be used in the study. This includes the study design, the research approach, the research sites, the data collection instrument and process as well as the analysis.

Chapter four presents findings that emerged from the field namely; policy and school prohibitive rules, teachers' attitudes and teaching styles, school facilities and relevance of science. Finally, chapter five presents the analysis and interpretation of the research findings as well as summarizes the research findings, limitations of the study, presents the conclusion and made recommendations for policy implementation and future studies.

2 CHAPTER TWO:LITERATURE REVIEW AND THEORETICAL PERSPECTIVE

2.1 Introduction

This chapter focuses on review of related literature and theoretical orientations adopted to help in analysis of the data on gender and science in relation to girls' low participation in science. The chapter begins with a definition of the concept school culture as pertain to the study. This is then followed by a review of relevant literature on gender and science education from other studies for the past three decades from other regions of the world. Literatures reviewed and selected are related to school and the interactions and practices that define its culture. This will be followed by perspectives adopted for the analysis.

School Culture

The concept school culture despite its wide usage and the development of vast literature on it for the past three decade has no universally agreed definition. Its meaning usually depends on the context in which it is expressed (Fengshu, 2006). Definitions on school culture most of the time is related to managerial discourses. The study therefore adopts Dimmock's definition on school culture to help in the articulation of research questions and for the analysis of data on the influence of school culture in relation to girls' low participation in science. Dimmock in Bray, Adamson and Mason (2007) defines school culture as:

> The enduring sets of beliefs, values and ideologies underpinning interactions, structures, processes and practices that distinguish one group of people from the other ..... the group of people may be at the school level or at the national level (p.285).

School culture or *the interactions, structures, processes and practices* in a school are the main elements that make up the context of schooling. This definition is relevant for the analysis of the findings emerging from the influence of school culture on girls' participation in science as the aim of the study is to explore and find out how the various interactions practices, structures and practice plays a role in influencing participation in science. School culture in this study is seen as a reflection of the wider social culture and comes as a result of conscious and unconscious interactions, processes and practices by individuals as well as the groups as active members of the society (Fengshu, 2007; Freire, 2005).

Life in all schools and in the classrooms is not separated from the daily happenings in the wider society. The hegemonic nature of life experienced in the wider society that makes one group within a society exercise much power over the other is also experienced in the school. This view is supported by Bray, Adamson and Mason (2007) as they indicated that a society's culture" does not stop at the schools gate". The activities of a school's life are therefore shaped by the norms and the values of the society at large. These conscious and unconscious interactions processes and practices within a school are also mainly influenced by the history of a school as schools history differs. This difference between schools is what distinguishes one school from the other leading to variations in interactions and practices.

In addition, Fengshu (2006) posited that even though a school may be distinct and have its own culture, that culture ''tends to be gendered in nature'' this implies that most often it is skewed towards a particular gender, class, race, power and so on (p.4) This she further explained as leading to the formation of gender regimes within school cultures as found in other institutions of the social structures of the society. This gender regime according to Kessler et al (1985) exists and operates in every school influencing the daily activities of the school. The gender regime affects every area of school life including organizational management, disciplinary schemes, interactions, processes, practices and relationships (Adamson, Bray and Mason, 2007; Fengshu, 2006).This usually depicts the picture of gender relationships that exists in the wider culture of the society in which the school is situated.

In the view of Fengshu (2006), two groups can be found in this case ; the in-group and out-group, the in-group that has and maintain control over resources and power represent the male ''dominated hegemonic masculinity''(p.4). The out-group on the other hand is made up female teachers and students and other group who most often do no aligned to the hegemonic masculinity. It is interesting to note that the gender relationships that can be found in the schools are not only emanating from the wider culture of the society rather the schools themselves are also the grounds on which such relationships are reproduced through the interactions between teachers and students in their everyday life.

However, in Brotman and Moore (2004) review on gender and science argued that such depiction of male dominance in science within the context of the school are almost eroding and becoming a thing of the past as there are a good representation of female teacher and science curriculum reflecting gender equity. On the contrary, other studies continue to indicate that transition from middle school to high school is the most critical moment where

girls often loses interest in science and mathematics and so do not offer courses in these subject areas. (Osborne et al, 2003; Sinnes, 2005; Schrenier, 2006). It is in the light of this that the study is focused on the school culture with a lens on the sociological and anthropological aspects of the classroom as schools micro culture.

Johnson (2012) on school culture identified three dimensions of the micro culture of the class room as school building and the structural context(infrastructure) procedures and processes, curriculum and assessments, the second dimension, she mentioned as sociological constitute the members of the school community social interactions and relationships. The last within the classification is the individuals which she mentioned are made up of the social preferences, perceptions experiences and expectations all normally interactions interact on daily basis. In the light of this the present study review literature on gender and science that also depicts the engendered natures of the school culture that segregate, discriminates and influences girls participation in science. Literatures reviewed spans from over four decades.

2.2 Literature Review

The low participation rate of girls in STEM has been the focus of most gender research in science education. This has led to a large but uncoordinated body of knowledge indicating why girls are underrepresented in science. This present study on school culture and its influence on girls' participation in science could review in detailed the volume of work on gender and science and therefore present a thematic review of literature relevant for the purpose and objective of the study. The literature has been put into two broad categories namely *institutional factors* and *individual factors*. Institutional factors in the study identify elements with the school such as (1) infrastructure that has to do with school facilities, (2) nature of science curriculum (3) school type and (4) location and safety. The individual factor focuses on teacher related factors such as (1) presence of role models (2) teaching style (3) teacher’s beliefs and attitudes towards students. To begin with, are the institutional factors affecting girls’ participation in science?

2.3 Institutional factors affecting girls participation in science programme

This aspect deals with the factors surrounding schools as an institution that influence girls' low participation in the study of science. It basically looks at factors such as available school facilities, gender biased school curriculum and school type.

2.3.1 Availability of school facilities

Several studies conducted in developing countries have shown that the lack of academic facilities is a persistent problem and is responsible for the low enrolment of girls, high dropout rate among girls and low participation of girls in science and mathematics (Adae-Menash, 2000;Babaci-Wilhite and Geo-JaJa, 2011; Kakinda, 2007).Most schools in Africa lacks the needed infrastructure for effective teaching and learning (Babaci-Wilhite and Geo-JaJa, 2011; Samoff and Bidemi, 2007). For instance Spreen and Vally (2006) in a survey of schools in South Africa found that 43 of schools have no electricity, 27 have no running water, 80 have no libraries and laboratories and 78 have no computers. Most of these schools are found in urban, peri-urban and mostly rural areas. Similarly a study of four African countries namely, Uganda, Cameroon, Tanzania, and Ghana, by O'Connor (2002) revealed that majority of the schools, primary and secondary, textbooks, laboratories, chemicals, tools and equipment, teaching aids, stores, and offices are either inadequate or are not there. . Addae-Mensah (2000) noted that in Ghana, only few senior high schools are well equipped with facilities to implement rigorous intensive science programmes and the best few can be found in the urban areas. Sinnes (2005) in her studies on "approaches to gender equity in Sub-Sahara Africa" indicated that owing to poverty most schools in the region lacks the needed facilities including textbooks, she noted that most of the books are not gender responsive leading to negative attitudes towards girls in science .

2.3.2. Gender Bias in School Curricula

In the opinion of many researchers, textbooks are agents of the transmission of society's values and attitudes and therefore are powerful tools in shaping learners' views of society. The content and illustrations found in textbooks cultivate positive or negative attitudes in learners about self-image, gender roles, occupations and chances in life (Brotman and Moore, 2008; Elgar, 2004; Fadigan and Hammrich, 2004; Harding and Parker, 1995). Studies from

various contexts have shown that despite efforts at promoting the learning of science by women, there exists gender bias in the science curricula in schools in most parts of the world and specifically Africa (Kitetu, 2008). This is done by presenting the masculine image of Science and mathematics by presenting in science and mathematics textbooks, classroom languages, examples, charts males engaged in scientific activities. Physics curricular in particular has been presented as having a more masculine image than biology and chemistry (Fadigan and Hammrich, 2004; Kitetu, 2008; Osborne, Simon and Collins, 2003).

Turner-Bowker (1996), with their feminist perspective mentioned, the critical role that textbooks play in education by stating that books provide role models from which "children learn what behaviour is acceptable for them, for their peers and for adults around them" (p. 463). Turner-Bowker (1996) goes to contend that the language and images portrayed in textbooks serve as mediums through which learners receive messages about gender stereotypes. These messages are used to perpetuate the gender stereotype (ibid). The consequence is that the content of textbooks influence the interaction between the 'messages' that society sends and learners' self-image or identity. This plays an important role in nurturing or breaking down gender role stereotyping.

Textbooks on science contain pictures that portray boys actively engaged in laboratory work whilst girls are portrayed as passive observers. Also most of professional shown as working in scientific field such as doctors, chemists and engineers are males (ibid). This practice disregards the presence and contributions of the female scientists. For instance, Obura (1991) in Kenya, Kalyati (1996) in Malawi, Sutherland-Addy (2002) in Ghana have also noted that women and girls are nearly invisible in textbooks, even in agriculture where women are very productive and contribute much of the labour. Similarly a review of textbooks in Gambia shows that despite efforts to remove gender bias in schools books, the tendency to portray women in nurturing, passive roles in relation to men persists (Odaga and Heneveld, 1995).
A study conducted by Elgar (2004) in Brunei of lower secondary science textbooks, indicates concerning illustrations the sex of the person portrayed was clearly apparent, the dress was distinctively male or female, and whilst the number of people mentioned by name was very low, not one female scientist was mentioned. The implication is that there is no female scientist role models to which girls could aspire and where photographs of women were used, the women appeared to be passive.

Regarding the text used in the science textbooks there only two instances of the explicitly gender-neutral formulation 'he or she' and in the use of generic language as a source of gender bias, 'there was no instance of the use of masculine gender pronouns being used to include females' (Elgar, 2004). This is an indication of gender imbalance in the illustrations in favour of boys, thus confirming the masculine image of science to girls and boys at the secondary school level.

A gender analysis of medical by Alexanderson, Wingren and Rosdahl (1998) also observed that the gender bias is prevalent in science textbooks in which the male is considered the norm and the 'invisibility' of gender differences comprising individual biological or psychosocial differences that women present. Alexanderson, Wingren and Rosdahl (1998) explained that one reason for the consolidation of the stereotypical sex pattern in science textbooks is that men wrote most of the science books. During my school days and through my experience as a teacher, most science textbooks contain male images. On the other hand even though Potter and Rosser (1992) in their study of life science textbooks found no proof of direct sexist language or the transmission of occupational stereotypes through the use of language, they did discover a significant bias in favour of male images in textbook illustrations, which created the impression that males are the norm as far as science is concerned.

2.3.3. School type and girls participation in science

Freire (2005) mentioned that school type place greater role in sustaining student interest in all activities, he added that school type either keep student in school or have the potential of drawing student away from school (p.9). Studies over three decades have indicated that school type influences the preference for and attitude towards science and mathematics (Rowe,1998; Young and Fraser,1990).Studies have shown that girls in co-educational schools have less favourable attitudes to subjects such as mathematics and physical sciences (Harding 1983).Also Young and Fraser (1990) indicated that school type being government, single-sex , coeducational, catholic and independent has a significant impact on achievement and participation in science.

On the contrary, there is a greater number of girls enroll in science and mathematics in single-sex schools found that physics was more liked by girls in single-sex schools compared with girls in mixed schools. Similarly, Dhindsa and Chung (2003) study in Brunei indicates that girls had a more positive attitude towards science than that of boys. They also found that girls and boys in single-sex schools had a marginally more positive attitude towards science than

boys and girls in co-educational schools. Also, Lee and Bryk (1986) study of Catholic schools in the US and Spielhofer et al. (2004) study in England stated that girls in single-sex schools show a greater interest in mathematics and are more likely to enroll on mathematics courses. This gives an indication that girls in single-sex schools are less likely to show interest in studying subjects that have stereotyped as female subjects. The American Association of University Women (AAUW, 1998) concurs that single-sex learning environments in primary and secondary schools do not necessarily eliminate sexism or lead to increases in achievement for girls.

Distance and safety at school

Another institutional factor that affects the participation of girls in general education as well as science education is distance to school. Most schools in Africa are situated far away from the residence of students making them travel long distance in the rural area and at the cities and towns. Majority of students also have problems with transportation. This has given rise to special concern for security and safety of girls in schools. Odaga and Heneveld (1995 cited in Nekatibeb, 2002) refer to a large number of studies in the region where it has been reported that the long distances girls (particularly rural girls) travel to school has two major problems: one relates to the length of time and energy children have to expend to cover the distance, often on an empty stomach, the other relates to the concern and apprehension parents have for the sexual safety of their daughters. In many African countries such as Ghana, the communities are small, sparsely populated and widely scattered. This poses problem for providing education for all as children have to walk long distances to access education in nearby towns (Casely-Hayford, 2002). Casely-Hayford observed that because of the dispersed nature of small settlements in the northern communities in Ghana most communities that do not have schools within five kilometre of their locality. Consequently, children in these communities walk 5-10 km or more to the nearest primary school and the nearest junior and senior secondary school even a greater distance, which constitute one of the major reasons for non-attendance In Guinea, studies show that close proximity of schools had a positive motivating impact on girls' participation in schools while in Mali, most girls stated that living far away from school and having to walk discourages them (Nekatibeb, 2002). Further, Fant (2008) argued that distance from the home to school has more negative effects on girls' school participation than boys, as parents are particularly more concerned about girls' safety on the journey to school due to sexual harassment..

Even though the issue of sexual harassment of girls in school is old sexual harassment and violence against girls in schools still persist (Gordon, 1995 cited in Bamora, 2010). Girls are daily targets of rape and sexual harassment. For instance Bamora(2010) found that in Zimbabwe, Ghana and Malawi both teachers and students often used sexual harassment and corporal punishment as a major means of controlling and regulating students' behaviour. The girls are in physical danger at school. The next factor to discuss is the individual factors.

2.4 Individual factors affecting girls participation in science and mathematics

In the school environment are inhabitant such as administrative staff, teachers and students who interact on daily basis. One of the areas within the school where most of such interactions take place is the classroom where there are two dimensions of interaction between teachers and student and also between boys and girls as social actors or subjects (teachers) that influence girls' participation in the study of science. Factors such as inadequate role models, teaching style, teacher's beliefs and teachers' attitudes that have been identified as influencing girls' participation in science will be reviewed.

2.4.1 Role Models

A number of studies have indicated that one of the reasons for the low participation of girls in science is the lack of role models (Ferreira and Patterson, 2011; Fried and MacCleave, 2009; Miles and Matkins, 2004)). Although female science students can be influenced positively by both female and male scientists (Miles and Matkins, 2004), female roles are said to have more effect on female science students and therefore increase their participation in science subject and professions (Fried and MacCleave, 2009). Lockwood 2006 enumerated three reasons why female role models are important in increasing female students' interest in science and scientific careers. The first is that outstanding female scientists can function as inspirational examples of success in science. Secondly successful female role models demonstrate that it is possible to overcome traditional gender barriers. Also female role models stand the chance of undermining traditional gender stereotypes about women; consequently they will thus reduce the persist effect of gender stereotype in most societies (p. 44). Kroch, Green and Newton

(2009) noted that parent, supervisor and teacher may be the least to influence students' decision in subject and career choices.

However, Gidden(2007) also adds that gender specific role models are particularly important in stimulating interest in science and increase their chances in choosing careers in science This is because students can identify better with someone who shares their background, especially for women in a traditionally male-dominated profession. Dee (2006) observes that the gender of the teacher has a significant impact on the students' performance. He believes that the impact can be 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). One reason offered by Dee for this positive outcome is that female science teachers are far more effective in promoting girls' engagement with this field of study (ibid p. 73).

There are many studies that indicate importance of female science role models in inspiring girls' interest to pursue science. Elstad and Turmo (2009) study of high school students in the relatively egalitarian society of Norway found that girls seemed to connect better with female teachers and felt female teachers created a better classroom environment. In a study of female students in the University of Toronto Lockwood (2006) found the participants were more influenced by female role models irrespective of whether they were interested in traditional or non-traditional female science careers. These female students stated specifically choosing female role models because of their accomplishments or overcoming gender barriers Yet, despite the positive effect of female role models and female science teachers, there are only a few number of science teachers to spur girls on learning science. A number of studies conducted in different parts of the world such as Rathgeber (2002) in African countries and Sengers, Levelt, Shanahan and Castillo (2008) in the EU countries found that the lack of female science teachers as role models in schools discouraged girls from participating in the sciences. Bussey and Bundura (1999) explain that this is expected as children learn subject stereotypes by observing the subjects mostly taught by males and females, and subjects most popular among boys and girls.

2.4.2. Teaching style

Science teachers can make a difference in girls' gendered perceptions and increase their participation in science by their teaching style and the strategies they use with respect to the

resources at their disposal in science classrooms (Cooper and McIntyre, 1996; Woolnough, 1994; Sinnes, 2004). There are varieties of teaching approaches and active learning strategies available to inspire, motivate and sustain students to study science and develop a positive attitude towards the subject. These range from the traditional "chalk and talk" to activity-based methods such as experiments, investigative work, group work, discussion, project work, Internet searches, role-play and excursions (Nautah, 2011; Mulema, 1999)

Roychoudhury, Tippins and Nichols (1995) explored the application of feminist ideas about women's learning to science teaching and they found that collaborative learning triggered empowerment and confidence among girls. Similar findings were made by other studies that cooperative learning groups and active learning motivate young women to study mathematics and science.(Capobianco,2007;Jovanovic andSteinbach,1998,Mulema,1999).This most of the time is missing in most Africa classroom due space, resources and large class size. Kahle (1996) also found that the performance of girls in science also enhanced by field trips, laboratory practice and career counseling, which help students see the relevance of science and mathematics in the broader context of work and life. Also participation in classes where teachers were trained in authentic assessment, cooperative learning, grade appropriate inquiry curricula, and the national standards in mathematics and science significantly changed the stereotypical masculine image of science as this led to a dramatic reduction in the number of boys and girls who thought science is for boys (Kahle 1996; Mulema,1999;Woolnough,1994).

Other studies contest the claim that cooperative learning always increases girls' participation and achievement. Lee and Burkham (1996) provided evidence that there are situations where girls were less likely to be helped by boys in cooperative groups, and, if there is only one girl in a group, the boys usually ignore her. It has also been found that even in cooperative learning environment boys were more likely to monopolize resources in small, coed settings, while girls were more often passive participants (Jovanovic and King, 1998). Also there no achievement gains for boys or girls associated with increased cooperative group work in high school biology classes (Kahle, 1996).

Another teaching style that has effect on girls' participation in science is hand-on experience or practical work. This teaching style is regarded as one of the distinctive features of science teaching and one of the great expectations of pupil learning (Brotman and Moore, 2008; Orsborne, Simon and Collins, 2003; Sinnes, 2004). Practical work such as handling tools and

equipment may boost girls' interest in mathematics and science (Greenfields, 1997).). Studies carried out in Norway (Angell et al., 2004) and in the United Kingdom (Hart, 2002; Sharp, 2004) as reported by Nuatah (2011) provide evidence for the value of practical learning showing that practical activities enhance the interest of pupils in science. As explained by Nuatah (2011) practical work makes science enjoyable and by exciting the curiosity of the learner, it develops positive attitudes to it. Surprisingly, hands-on science teaching style had no effect in reducing the gap between boys' and girls' science attitude as this teaching style is experienced by boys and girls differently. She (1999) noted that girls manipulate equipment less than boy even in a class with the most experienced teacher. However hand-on experience learning has continues to be identified as effective way for engaging girls in practical subjects including science.(Cooper and McIntyre, 1996; Mulema, 1999). However, Dawson (2000) noted this hand-on experience teaching style is most often missing in science classroom and my experience in the science classroom as student this is woefully missing.

O'connor (2000) found that in most countries teachers favour teacher-centred, knowledge based teaching methods that leave little or no room for learners' participation. He concurred that the most commonly used teaching methods at both primary and secondary level were found to be lecturing; question and answer; explanations of procedures and note giving, in that order. Little practical work is undertaken as result of shortage of equipment and consumables. Consequently the development of a scientific way of thinking is abandoned in favour of the learning of nomenclature, definitions and stock standard procedures (O'Connor, 2000).

The author therefore identified inappropriate teaching methods as one of the factors that contribute to the low participation and performance of girls in science and mathematics. Participants in O'Connor's study felt that the teaching methods used were not practical enough and that teachers made little effort to relate the concepts learnt and use illustrations that are common to the concrete life situation of students and their environment. For instance the entrepreneurial skills of market women, kiosk owners and street vendors involving quick-fire mathematical calculations; instant judgment of what is a good to buy or a good sale; and the means of mathematical reckoning they use; the use of patterns in tailoring and dress-making as an example of symmetry; the kind of geometry involved in basket weaving, tile making, bead work, hair styles etc., are never mentioned in mathematics classes (O'Connor, 2003). Also different types of modern and complex mechanical examples of friction are

quoted in science classes, but the grinding of grain into flour, carried out by millions of women every day is ignored

Other studies found that curricular changes, teacher training and small single-sex classes, increased interest, achievement and feelings of self-confidence in both boys and girls (Haussler and Hoffmann, 2002). Zohar and Bronshtein (2005) examined teachers' knowledge and views about gender gaps in physics participation in Israel and their findings showed that teachers did not know about gender inclusive pedagogy.

2.4.3 Teachers' Beliefs

Teachers are important influence on girls' decision to pursue science (Dentith, 2008). Therefore teacher's belief about girls can have both negative and positive effect on the rate of girls' participation in science. It has been found that the expectations teachers of students and their belief of the science and mathematics ability of girls and boys is a factor that explains the participation rate between boys and girls in science and mathematics (Osborne, Simson and Collins,2003; Sinnes,2004).

Lon and Fofanah, (1990) as well as Cammsih and Brock (1994) in Cameroon and Davison and Kanyuka (1990) in Malawi have observed that there is a belief among both female and male teachers that boys are academically better than girls.

Fengshu (2006) and Davison and Kanyuka (1990) have mentioned that teachers have different expectations of female and male students, which lead the teachers to overrate the science and mathematics abilities of the males and underrate that of the females. The expectations of which teachers hold for boys and girls are shown in differential treatment on the basis of sex in the classrooms (Dee, 2006).In the classroom interaction with students teachers may indirectly communicate that they have different academic expectations of boys and girls and these biased expectations of teachers may then become self-fulfilling when students respond to them (Fengshu, 2006).

Tiedemann (2000) in a study of elementary school teachers found that teachers have the believe that girls are less rational than boys, even among boys and girls performing at the same level, and teachers believe that girls need to work harder in mathematics than boys to achieve the same level of performance. An earlier study by Kahle, Anderson, Damajanovic (1991) of teachers from the United States and Australian showed that they perceived girls in

their classes as less interested and less confident in physical science. The teachers believed that female student' attitudes about physics were more negative than male students' attitudes This expectation of boys and girls has been shown to be inaccurate in a number of studies (Greenfields, 1997; Kitetu, 2006)

Another school related factor that has been shown to have profound effect on girls' participation in science is the teachers' beliefs and attitude towards students (Nuagah, 2011; Dentith, 2008; Warrington & Younger, 2000; Woolnough, 1994). According to Cooper and McIntyre (1996) the interpersonal interaction that takes place in science classrooms, especially between teachers and girls, is very important in understanding girls' declining interest in science careers. The question of the low participation of girls in science must include investigation into the more indirect aspects of classroom climate, which they labeled as 'chilly' for girls. Teachers facilitate the learning process through the interaction that takes place in science classrooms and have a major effect on learners' acquiring a gendered or balanced perception of science and science education (Sinnes,2004). However, the attitude of teachers towards boys and girls can be favourable or unfavourable (Schreiner, 2006).

Many studies over the years have demonstrated that teachers treat male and female students differently. Science teachers have been found to give more attention to male students than female students. On the whole teachers have been found to give more attention to boys (Blickenstaff, 2005; Dentith, 2008; Warrington and Younger, 2000). The less attention given to female science students have been shown to negatively affect the attitudes of girls towards science, their motivation, their continued participation and achievement in science (Labudde, 2000). This situation is more pronounced in co-educational institutions in both developed and developing nations. Both male and female teachers show such biases towards their students (Mattern and Schau, 2002). However, there are behavioral and attitudinal differences among teachers regarding their attitude towards students based on gender of teacher and that of the student they are interacting with (Jones and Wheatley, 1990). Male teachers have been found to show more bias towards girls in the classroom by ignoring them (Kitetu, 2006). Also male teachers asked significantly more direct questions of students than female teachers and male teachers warned boys and girls with approximately the same frequency. Female teachers, on the other hand, had significantly more warning interactions with boys than with girls (Jones and Wheatley, 1990). This substantiates Kelly (1988) earlier observation that:

> Male teachers directed fewer of their interactions at girls than did female teachers and the gender differences were larger in science, social studies and mathematics than in other subjects. The major result is that across a range of countries, ages, dates, subjects and social groups, boys consistently received more attention from their teachers than did girls in the same class.…This is particularly true of feedback that is "praise and criticism where male teachers virtually ignore their female students." (p. 17-18).

Teachers have been found to be the ones who promote the dominance of boys over girls in classroom situations (Asiimwe, 2008). For instance in a meta-analysis of international research on gender differences in teacher-student interactions of the quantifiable data obtained from 81 studies from the UK, Canada, USA, Australia and Sweden, Kelly (1988) indicated that girls showed willingness to participate in science lessons but did not receive their fair share of teachers' attention in class. Kelly estimated that on the average spend 44% of their time with girls and 56% with boys, so that by the end of a school career a girl will receive 30 hours less individual teacher attention than a boy although this was across all school subjects, these differences were particularly. The study further revealed that boys had a tendency to call out the answers to questions before being selected by the teacher to answer. Though girls raised their hands, they received less attention and were not able to participate as much as the boys. Teachers have been found to give boys both more praise, challenging questions whiles girls receive more criticism(Fengshu,2006).Studies have shown that males receive encouraging remarks made by teachers, while females received discouraging remarks. Teachers call on boys more often and accept more things blurted out from boys, and they tend to follow up more often and at greater length with the responses from boys (Anderson-Leavitt et al 1994; Mattern and Schau, 2002).

Teachers beliefs and attitudes in the classroom contributed to this disparity because they did not give girls a chance to talk, disregarded what they said when they got the chance, and did not take them seriously as equal participants in the classroom. Other ways by which teachers give boys more attention is by discriminately encouraging boys to be assertive, curious, questioning and active). On the contrary girls who exhibit such assertive behaviour are labeled as obnoxious and witches in the Ghanaian context(Anamuah-Mensah 2000).Teachers more often also asked girls only simple recall type of questions but direct the more difficult, reasoning type of question to boys (Oconnor, 2000). There is often a mistake on the part of teachers to save girls from potential difficulties with science and mathematics as well as to save themselves from having to teach the girls, which they claim would require 'enormous effort' (ibid).Research has also demonstrates that teachers interact more with boys because

they receive more pressure from boys (Dentith, 2008; Warrington and Younger, 2000). It has also been found that girls themselves attribute the reasons for teachers given more attention to boys to the fact that their male counterparts understood the subject better and "that the teacher seem easily frustrated with the girls and was irritated by their question" (Warrington and Younger, 2000, p. 498).

Jones and Wheatley (1990) explained that the gender-related difference in student treatment is that science teachers use feedback as a control mechanism over student behavior. Teachers try to gain control over a class by giving boys more positive feedback as well as negative feedback, which is often expressed as behavioural warnings (Haase, 2009). These warnings, although initially perceived as negative treatment "may in actuality have positive effects on the male student" (Jones and Wheatley, 1990, p. 869). These patterns, therefore, substantiate gender-role behaviours and strengthen the hegemonic societal structure that is mirrored in the science and technology classrooms (Haase, 2009).

Much of this negative attitude displayed by the teachers towards girls derives from the masculine image of science which many teachers may have acquired from the larger society (Jones and Wheatley, 1990). The effect is that given more attention to boys and less to girls annoys girls (Warrington and Younger, 2000)., The authors further noted that this de motivate girls in science leading to girls opting out of science and consequently low number of women pursuing science studies and careers. In the opinion of Kahle and Meece (1994) these classroom interaction patterns leads to gives boys an edge over girls to learn science and may clearly indicate teachers' favourable achievement expectations for boys.

This differential treatment of boys and girls in the classroom supports the notion that boys actively participate more successfully than girls in science. In the opinion of Kitetu(2006) this kind of teacher action affirms the 'science is for males' gender stereotype in science classrooms and increases the hurdles that girls contend with regarding their engagement with science. This buttresses the view that teachers' actions in class promote the 'hidden curriculum' that reminds learners that science is for boys (O'connor, 2000). Thus, the stereotypical attitudes toward girls in science classrooms are promoted by teachers (Kahle and Meece, 1994). It is also an accepted fact that teachers, especially male teachers, play an important role in the development of hegemonic masculinities that prevail in schools (Skelton, 2003). Skelton goes on to state that the attributes and practices of the male teachers

contributed towards “a mode of dominant masculinity which mobilized around a sharing of masculine ‘values’ in this case a sense of ‘team spirit’ fuelled by the use of humor” (p.24).

Also Nekatibeb (2002) noted that teachers prey on their female students, threatening to fail them, or publicly humiliate them, to prod them into sexual liaisons. Teachers are also reported to reward female students who 'co-operate', with grades and tuition waivers (ibid).

2.5 Theoretical Framework

Gender and science has been the concern of the research community over the past four decades and from various perspectives, studies conducted have attempted to find out why inequality persist between boys and girls in STEM. Researchers like, Eccles have implored motivation and socialization theories to understand the low participation rate of girls in science.

Theories such as expectancy value theory and socialisation theories that explained the phenomenon largely blame it on the attitude, achievement and perception of girls towards science. These theories emerged from the field of social sciences including economics, sociology, anthropology, psychology and education and have identified several factors that are responsible for the low participation rate of girls in STEM.

In trying to understand the phenomenon in this study, I present a framework from three perspectives namely: *Critical Pedagogy* which describes how teachers as cultural workers within the school are influenced by the politics of the society and this affect their interaction with their students Again it explained the professional qualities all teachers in all societies must possess to be efficient in their classroom interactions *Cultural Production and Reproduction* which focuses on how educational institutions turn to produce and reproduce dominant groups’ desired values norms programmes and *human Right Framework*, which focuses on how school structures and policies can subtly deny girls equal chance to participate at par with their male counterparts.

These chosen perspectives complement each other and are useful and indeed necessary to understand the phenomenon under study. For the purpose of clarity, the *critical pedagogy* will be presented and this will be followed by *cultural production and reproduction* and conclude the theoretical section with the *human right framework.*

2.5.1. Critical pedagogy

The role of teachers is very critical in the teaching and learning processes of every student. Owing to the critical role they play in the life of the learners, it is very important that they are well qualified and have firm grip on their subject matter and methodology in teaching but in most case this does not happen. According to Geo-JaJa (2013), in most developing regions of the world especially Africa most teachers are not professionally competent which affect the delivery of lessons both in content and methods In his work "teachers as cultural workers" Freire(2005) mentioned that teachers are expected to discharge their duty with *professionalism.* Professionalism Freire explained as a teacher's ability to blend theory with practice and not only carrying professional tags that has no bearing on real classroom practices. This implies that a professional teacher must be competent in the content of the subject area and well versed in methodology. Woolnough (1994) in a similar vein on graduate professional teachers argued that in additionally must have good expertise across his or her subject area.

Again, Freire (2005) stated that a professional teacher acknowledges that he does not possess all knowledge, he or she is aware that the students also possess knowledge that need to harness. From this premises the teacher then acknowledges, appreciate and make room for the learners' knowledge during classroom interactions (ibid,p.xxxiii). The students' are therefore to be treated with respect and concern irrespective of their gender .Similarly Myers and Fouts (1992) in their studies on attitudes towards science also mentioned that a teacher's professionalism is seen in the use of variety of teaching strategies and unusual activities to help the diverse students in a given classroom. This help cultivate and sustained the interest of girls even in science education and boost their participation rate through the pipe line to take up careers in the field of science even later in life.

Freire (2005) on teachers' professional attitude further stated that love must be the foundation on which teachers "live and discharge their duty". Ones love for teaching will make a teacher treat all students equally and make room for their struggles and challenges during teaching and learning processes. This will make the teacher appreciate the individual difference of the learner and design pedagogical approaches that will benefit all without segregating and discriminating against anyone during the teaching and learning processes He however cautioned against ''coddling'' or pampering of students. Teachers pampering and acting as parent at home may not be in the best interest of teachers and students, such acts might be

seen as weaknesses in the teachers and likely to be taken for granted by students. Nevertheless, teachers are not expected to be rigid during teaching and learning processes but instead during classroom interactions show love to students, must be fair and firm to all in the classroom. There is a clear distinction between coddling and teaching: acting as such undermines professionalism. Simpson and Oliver (1990) on teaching style of a professional teacher that will stimulate and sustain students interest argued that teachers are to use effective pedagogy designed within the social context of the students that will make them feel valued, cared for and accepted as this make them feel as noted by Freire (2005)secured and boosting their participation in class. Freire identifies some virtues that a progressive and professional teacher must exhibit in addition to *love* characteristics of the progressive teacher those of humility, courage, tolerance, decisiveness, security, patience……' (p.42), these virtues are to be found in all teachers in every school environment irrespective of the geographical location for effective teaching and learning to take place. Most studies on school culture have reported that there are evidence of discrimination and segregations during classroom interaction between teachers and students and also between student and students at another (Fengshu, 2006; Osborne, 2003) The study will incorporate *love, humility, tolerance and security* as identified by Freire as qualities every progressive teacher must possess to increase student participation in the classroom as relevant tools for the analysis of data on school culture and girls participation in science. This is because the Ghanaian society is highly patriarchal and there exist hegemonic culture that plays out in all the social institutions including the school. This leads to segregation and discrimination against girls in the classroom setting.

According to Freire (2005), teachers are social agents who are actively involved in the politics of the world in which they live. He writes "teacher do not live in a pristine world devoid of ideology, of racism, of social class, but rather they live as social and political agents who challenge their students"(p.xxxvi). This implies that the teacher has influence over their student and so their beliefs, value and norms of the society comes to play in their day to day interactions with their students. This then influences their identity formation (Delamont, 1990; Fengshu, 2006) and consequently their participation in class. Freire, (2005) asserted that teachers as cultural workers are actively engaged in the political game of power relations that exist in the society as he argued that they are involved in "discourse and practice" that favour the weak and poor" and their conflict and political activities favour the powerful in the society. Thus the interactions between teacher and students most often than not turns to

favour those who are already in the position of dominance? Kassel et al in a similar vein stated that this within the school create gender regimes. This they defined as "patterns and constructs which create various kinds of masculinity and femininity among staff and students, orders them in terms of prestige and power and construct a sexual division of labour within the institution".

Furthermore, Freire (2005) argue that this should not be the attitude of the teacher rather they are to exhibit professionalism in which he described as one of humility, love, security and tolerance. This leads to the second theoretical consideration in this study that describes how when teachers do not act professionally can become agents that turn to produce and reproduce culture of dominance that is portrayed in the field of science.

2.5.2. Cultural Production and Reproduction Theories

Cultural reproduction and reproduction theories consider the school environment as the ideal time to influence attitudes and build long-term loyalties (Bourdieu, 1996;Fengshu, 2006; Freire,(2005) Educational institutions are seen as being engaged in producing and reproducing the dominants groups' desired values and norms. Freire (2005) asserted that teachers are teachers as cultural workers are social agents who are also involved in the politics of the societies where they live. For critical feminist educational theorists, the school curriculum is one that reflects dominant group interest meant to be reproduced in the learner to perpetuate their dominance (Osborne, 2003). Cultural Reproduction theory is concerned with the production of class structure, while the cultural production theory is concerned with mutations of class, knowledge and power relations (Fengshu, 2006). Together they emphasize the idea that student learning is shaped by their class position in society as well as the experiences derived from their learning environment (Brotman and Moore, 2004). As such girls' interest to choose or study science is influenced by their experiences gathered from the two environments through their daily interactions.

In the Ghanaian society women and girls are mostly seen as playing second fiddle to boys and men and these experiences usually reflected in the schools and this make the girls shy away from science largely due to the masculine image portrayed in science. Weiler (2000) in a similar vein argued that "students are shaped by their experiences in schools to accept a subjectivity and a class position that leads to the reproduction of existing power relations and social and economic structure" (p.6).

In using these theories the school environment is the field in which interaction between student and teachers takes place. It is also a place where the scientific and mathematical knowledge are transmitted to students as well as a place for the transmission of societal values, which may be positive or negative for girls. In the school classrooms where knowledge is transmitted the stereotypical image of science as girls who would then accept the dominant male culture of science encounter masculine. This may lead to a negative attitude towards science by girls and consequently their low participation in the subject. Also, the school is a miniature society and the teachers duplicate most of the negative attitude the larger society has towards girls in the school. The Ghanaian society is highly patriarchal and gender roles are clearly defined, women and girls are expected to take up jobs that are related to the domestic roles they play at home that. This attitude and stereotypical mindset is exhibited by most teachers towards girls who participate in science.

2.5.3. Education as Human Right

The Right based approach originated from the 1993 United Nations (UN) conference held by member states in Vienna on human rights (Babaci-Wilhite, 2014). At the conference, Declarations and programme of Action were born that linked democracy to human right and development (Hamm, 2001).Various laws were passed that confer several rights to all humans and notable among them is the right to education without discrimination as stipulated in Article 26 of the United Nations Declaration of Human Rights (1948).

Indeed education is the primary tool by which all people in the world and especially Africa which has been bedeviled with persistent poverty can be lifted out of its predicaments. Again, it is the means by which an individual can enjoy many other human rights. In order to make the right to education a reality, Babaci-Wilhite (2014) mentioned that the United Nations Secretary General at the conference called on all organizations and agencies to draw an action plan that will make government of nation states responsible for ensuring right based approach to education. Ghana is one of the nations in Africa that signed in for the right to education to all its citizens. It has therefore become imperative for the government to offer education that promote participation and social and economic development that will make all her citizens competent participants in the global economy. Osborne, Simson and Collins (2003) mentioned that current available jobs are reported to be in the field of sciences and if women and girls in Ghana who form more than half of the total population are to participate fully in the global economy, then they need to be fully engaged in sciences at the senior high school

which is the pipeline to careers in the field of science .However looking at the nature of gender disparity in science education in the country especially at the senior high school it becomes clear that policy makers in education are not ensuring right in science education, the government has not come to the realization that right in education goes beyond entitlement and primary education and for school authorities to create school environment that has the potential of breaking overt and covert barriers that hinders equal participation in science; and in particular classroom environment that is conducive for teaching science.(Babaci-Wilhite, Geo-JaJa, 2011), Spreen and Vally(2006) and Tomasevski (2006)mentioned that in situations like these, one thing that is clear is the fact that such issues confirms the invisible nature of the rights expressed in education in most Africa countries. Babaci-Wilhite et al(2011)argued for the need for the right to education in terms of availability and accessibility as well as right in education in terms of and respect for students need that will ensure equal participation. Donnelly (2003) in agreement to this posited that all humans are to be treated with concern and respect by making available equal opportunities for their advancement and well -being. Rights are defined as entitlements that all human beings own irrespective race, colour ethnicity, gender and socio- economic background (Babaci-Wilhite, 2014; Naussbaum, 1998).The rights- based approach has been considered as the foundation on which Nation States take decisions and follow processes to effect change because of the norms and values they represent.

Since the declaration of right to education much attention has been paid to access to education by ensuring gender parity in education with much focus on basic education. This over the years has yield considerable results globally though most developing regions of the world are still lagging behind. Current studies on education as a right are now shifting focus access issues and critically examining issues pertaining to *participation in* education as a right using local language (Babaci-Wilhite, 2013). The present study in a similar vein is arguing that right to education discourse should be moved beyond equal access to equal *participation in* all programmes and activities within the school for boys and girls by removing overt and covert barriers that may hinder parity in participation for social and economic justice (Tikly and Barret, 2013).

However, in Africa for instance in Ghana opportunities in education are not available for all at the various segments of education as certain schools are materially more endowed and in terms of human resources and infrastructure than others. The right-based approach is relevant to this study because in Ghana, education is recognized as a human right and it is guaranteed

by the 1992 constitution of Ghana. Ghana has also ratified several international conventions on the rights of children especially girls to have access to education. These include the 1948 Universal Declaration on Human Rights Education for All, the Dakar Framework, and the Beijing Platform for Action. For this reason Ghana has taken steps to promote education of children enrolment and retention of girls in school at the basic level. Though efforts have been made to encourage girls in the participation of science in the senior high school yet girls are still underrepresented in science. Meanwhile education as a human right means everyone including girls must have equal access and participation in the educational process. They must have the chance to choose the schools and programme they wish to study. As a right all barriers in the form of attitudes on the part of teachers, policies and rules that may subtly denial any of the genders access and the deep- seated societal value that subtly operates in the schools and hinder access and participation of girls in science education must be dealt with to make it accessible for all to study. This then connects the presentation to a focus concept school culture which can influence the study ‘‘girls’ low participation in the study of science (STME)”.

3 CHAPTER THREE: RESEARCHMETHODOLOGY

3.1 Introduction

This chapter presents the research design, which constitutes methods and procedures used in the study. It presents information about the research site, description of the target population, the sampling technique and method for data collection as well as instruments used and field experiences.

3.2 Research Design

A research design represents a plan of how particular study should be conducted. It is a framework concerned with the type of data that will be collected and the means used to obtain them and how the data is analysed (Creswell, 2013;Bryman, 2008). Furthermore, research design can be explained as the overall plan to be used and follow in answering the research questions. Thus, it involves deciding on what type of research questions to use and the answers to them while considering the best way to gather data required for the study.

This study aims at exploring the influence of school culture on the participation of girls in science programme at the senior high schools in Ghana. The case study design is adopted for the purpose of exploring in-depth knowledge on how school culture influences girls' participation in science and mathematics in Senior Secondary School in Ghana. The case study is a strategy for conducting research, which involves an empirical investigation of a particular phenomenon within its real life context using multiple source of evidence (Creswell, 2014). It involves an in-depth exploration of bounded process or individuals system based on extensive data collection (Yin, 2009)). The bounded system could be an individual, a classroom of students or a particular mobilization of professionals (Stake, 1995). Also a case study as a bound system means that the study is located within a geographical boundary, which is limited by number of informants providing the data for the study (Yin, 2009).In this study the cases under examination are four Senior High Schools in the Greater Accra Region of Ghana. This reason for this is to get a deeper understanding of the phenomenon under investigation. Therefore I am interested in information-rich cases in order to come out with the most information rich of each case.

There are three main types of case study designs, which have been identified by Stake (1995). Theseare:

- Intrinsic case studies (studies that are undertaken to understand a particular case in question);
- Instrumental case studies; (examination of a particular case in order to gain insights into a theory or an issue); and
- Collective case studies (groups of individual studies that are undertaken to gain a fuller picture).

The importance of this case study is that it is flexible and adoptable to processes, people and context and provides some of the most useful methods in educational research (Yin 2013). Additionally, the case study design has other special features, which can be particularistic, descriptive, heuristic and inductive (Merriam, 1988). The particularistic case study focuses on particular groups of people confronting specific problems and takes a holistic view of the situation whilst in a descriptive study there is a rich, thick description of the phenomenon under study (Bryman, 2012; Gall, Gall and Borg, 2007).). In this study a collective case study design of four selected schools have been employed to provide insightful analysis and interpretation of the situation of girls' participation in the study of science in Ghana. The choice of a case study is also appropriate for this study because it deals with the "How" and "Why" qualitative questions are explored (Yin, 2009). The purpose of qualitative questions is to unravel how processes happen, how different people perceive, experience and respond to these and untangling the complexities, complications and contradictions (Bryman, 2012; Gall, Gall and Borg, 2007).

Some researchers have criticized case studies as being weak in terms of generalizability and validity (Woolcott, 1995). In this study this weakness was overcome by defining what the case is and what the unit of analysis is. As noted earlier, the case for this study is the school culture that is responsible for the low participation of girls in science and mathematics in senior high schools in the Greater Region of Ghana. The unit of analysis is four schools, teachers, female science students and official of the Girls Education Unit and the science and mathematics clinics.

3.3 Research Approach

The research approach is qualitative and aimed at understanding some aspects of social life through the generation of words rather than numbers as data for analysis (Bryman,2012;Chambliss and Schutt,2009).The qualitative approach refers to any kind of research that produces findings not arrived at by means of statistical procedure or other means of quantification (Strauss and Corbin, 1991). Brock-Utne (1990) argued that it is an approach where participants are allowed to freely express themselves about their social world rather than tied to questioners to meet the expectations of the researcher. In other words qualitative research involves the narrative description of events and phenomenon within their natural settings without the use of quantitative measures. It is a naturalistic inquiry, the use of non-interfering data collection strategies to discover the natural flow of events and processes and how participants interpret them.

In general, qualitative research shares the theoretical assumptions of the interpretative paradigm, which is based on the notion that social reality is created and sustained through the subjective experience of people involved in communication (Bryman,2008)). The concern of qualitative researcher is to accurately describe, decode and interpret the meanings of phenomena occurring in their normal social contexts. Qualitative researchers therefore focus on investigating the complex, real, and within a specific context, shared subjective experience of the researcher and the research participants.

Qualitative research in general is more likely to take place in a natural setting (Chambliss and Schutt, 2009). By implication, this suggests that studies that utilize the qualitative approach focus on everyday activity as participants go about their normal duties. .Miles and Huberman (1994) propose that qualitative research method is conducted through an intense or prolong contact with a life situation that reflects the everyday life of individuals, groups, societies or organizations. Thus, the major data for the study were collected from four schools. I visited the schools and participated in classroom activities for a period of one month. This enabled me to familiarize myself with the school environment, participating in classroom activities, observing the various science classrooms within each school, the schools' science laboratories and facilities which later helped to accurately describe the school environment, the classrooms interactions and school practices.

The qualitative research is suitable for this study because this study aims at describing and analysing data from students and teachers as well as the collective thoughts, beliefs,

perceptions and actions that influence the participation of girls in science and mathematics with the focus on school culture Furthermore it enables the researcher to gather data by interacting with the selected participants in their natural settings to obtain relevant information on topics under study (Chambliss and Schutt,2009;Bryman,2012).Additionally, I used a qualitative method in this study because my aim to emphasize on peoples' lived experiences that are fundamentally suited to locate the meanings people (that is female science students and teachers) attach to events, processes and structures of their lives, their perceptions, assumptions, pre-judgments and pre-suppositions (Miles and Huberman, 1994). In this case the use of the qualitative allowed the researcher to explore various forms of daily lives of female science students in the four schools such as their interaction with teachers, interaction with male science students. Furthermore, as indicated earlier, this study is focused on answering questions as to Why, What and how of a phenomenon which is the goal of qualitative research rather than quantifiable number of the phenomenon (Yin, 2003; Bryman, 2012).

More so the qualitative research approach is appropriate for this study as this is relatively an unexplored topic in Ghana. According to Strauss and Corbin (1990), qualitative methods are useful to unveil knowledge and to facilitate our understanding on phenomenon that little is known about.

3.4 Research site

The Greater Accra Region and the Accra Metropolitan Assembly (AMA) was selected for this research for two reasons. Firstly for accessibility and time, and also for the fact that the headquarters of the national Science and Mathematics Education (SME) clinic a summer science school which is organized for all school junior high and senior high schools in Ghana is located in the AMA. The researcher can ascertain gender parity in science education in Ghana has still remained a distant dream (Anamuah-Mensah, 2000 ;). I have interest in girls and science education with the belief that their participation in science will help them access jobs in future as studies have indicated that recent jobs can be found in the sciences and its allied fields. (Brotman and Moore,2008; Osborne, Simson,Collins,2003) Again their participation in science will help reducing maternal mortality, mal- nutrition and managing the environmental challenges bedeviling the nation. Within the Region, four schools were selected, two government assisted and two public. The selected school share similar characteristics as well as difference. Their similarities lay in the fact that recruitment of

teachers, and their salaries and provision of facilities are the sole responsibility of the national government. Also all these schools use the same national curriculum and take the same examinations. These schools however differ because they are in different districts and mostly administratively, the government assisted schools are co-managed by the national government and individual early churches such as Methodist, Presbyterian, Roman Catholic and Anglican churches. Their differences therefore in most case influence the day to day running of the school and their achievements.

3.5 Study Populations and Target Group

The study population for this study was all female science students as they are the main focus of the study, science teachers in the various senior high schools visited Ghana and an official of the Girls Education Unit and the science and mathematics clinics of the Ghana Education Service. For the purpose of this study the target population was the female science students and science teachers in four senior high schools in the Greater Accra Region of Ghana, an official of the Girls Education Unit and the science and mathematics clinics of the Ghana Education Service in the Greater Accra Region of Ghana. This participants were targeted because the Girls Education Unit are responsible for promoting the educational accessibility, enrolment, retention and increasing the participation of girls in science, technology and mathematics education (STME) subjects by improving the quality of teaching and enhancing the perception of these subjects (GES,1999 cited in Sutherland-Addy, 2002)

The office of the science, technology, mathematics and education clinics among other things is responsible for increasing the enrollment of girls in primary education and their interest in courses, especially those in the field of science, mathematics and technology in Ghana.

3.5.1 Sampling and Recruitment of Participants

Purposive sampling was the main technique used in selecting participants for this study. Purposive sampling involves intentional selecting special groups of people who are in the position to answer the research questions or they have characteristics that typify the participants sought by the research. According to Cohen, Manion and Morrison(2007) in purposive sampling, researchers hand pick the cases to be included in the sample on the basis

of their judgment and the cases "typicality and thus build up a sample that suits their specific needs satisfactorily" (p.103). In Ghana there are co-educational and single-sex with the former being the predominant type. These schools are classified as Mission Run Schools, Government Assisted Schools and Private schools. Due to the fact that the study is looking at how school culture affect the participation of girls in science, two government assisted and mission run Schools each were selected. The phenomenon of private senior high schools is a recent development in Ghana and therefore private senior high schools were excluded from the study. As advocated by Bryman (2012), the advantage of the purposive sampling is that the researcher can use his or her skill and prior knowledge to select participant with the relevant information. In applying the purposive sampling technique the units of the sample are selected not through random procedures but by intentionally picking them for the study. This is because of either their characteristics or the fact that they satisfy certain criteria, which are not randomly distributed in the population but are typical or exhibit most of the characteristics of interest to the study (Bryman, 2012; Chambliss and Schutt, 2009). Using purposive sampling, two co-educational schools each were selected from among the mission run schools and the Government Assisted Schools. As advocated by Denzin and Lincoln (2000) "many qualitative researchers employ purposive, and not random, sampling methods because they aim at study social actor within their natural environment. Another reason for choosing the purposive sampling was because there are different categories of students, males and females, in the four schools offering different subjects. All the four schools chosen for this study offer at least five courses namely: General Science, Agricultural Science, General Arts, Business Studies, Visual Arts and Home Economics. Equally there are different teachers for each of the subjects within the various courses. Therefore it would be difficult to get all female science students, all science teachers and the appropriate officials of the Girls Education Unit and Science, Technology, Mathematics Education Clinic to answer the research questions using a probability sampling technique. Therefore the researcher used the purposive sampling to intentionally handpick the participant who are affected by the phenomenon (girls) have interest in the phenomenon (teachers, School administrations) those designing policies and interventions to overcome the problem of girls under-representation in science, technology, mathematics education in Ghana (GEU and STME). In all the purposive sampling strategy was used to select 21 respondents for the study. This consists of the four female science students each from each of the selected schools (16 girls), one science teachers from (4 teachers) each of the four schools and one official from the Girls Education Unit and Science, Technology, Mathematics Education Clinic (1officials). Table 2 shows a list of schools and

participant of the study. Participation in the study was voluntary for all the teachers and female science students and the teachers. In each School the head of the Science Department accompanied me to each of the science classes in Form Three. After the brief introduction by the Head of the Science Department I explained the aim of the study and requested those who are interested to come to a special place designated for the interview.

Table 2 List of schools and participants of the study

CATEGORY AND NUMBER OF PARTICIPANTS

Category	Government Assisted	Public School	Total
Students	8	8	16
Teacher	2(1 female)	2	4
Educationist (STME Dist. Coordinator)	-	1 (female)	1
Total	**10**	**11**	**21**

3.6 Methods for data collections

A methodological triangulation of interview, observation, pictures and the use of documents were used to gather information for the study. The selection of these methods was informed by the ease of administration, ease of eliciting response, validity and reliability of the instrument, practical limitations of time and cost and the fact that this work is more qualitative. These methods especially the interview method have been used extensively in educational research in developed countries, Africa and in Ghana (Bryman, 2012; O'connor, 2002).

3.6.1. The interview

The major instrument used in gathering data for the study was the interview. An interview is a two-person conversation initiated by the interviewer for the specific purpose of obtaining research relevant information (Kvale and Brinkmann, 2009)). Interview is also viewed as one of the main data collection tools in qualitative research and a very good way of assessing people's daily experiences and their inner perceptions, attitudes, and feelings of reality (ibid). Qualitative interviewing is quite different in many aspects in comparison with interviewing in

quantitative research. Qualitative interviewing is generally much less structured (Bryman and Bell, 2007). Also, qualitative interviewing is usually flexible. Thus it enabled the researcher undertaking the interview to adjust and respond to the interviewee. In qualitative interviewing there is a great interest in the respondents' point of view, detailed and rich answers are desired the interviewer is allowed to depart from any schedule that is being utilized, new questions may arise due to respondent´s replies and the order of questions may be revised (Bryman and Bell, 2007).

There are two types of qualitative interviewing namely: unstructured and semi-structured interviewing. Minichiello, Aroni,Timewell, and Alexander (1990) write that unstructured interviews are interviews in which neither the question nor the answer categories are predetermined. Instead, they rely on social interaction between the researcher and the informant. Punch (1998) described unstructured interviews as a way to understand the complex behavior of people without imposing any a priori categorization, which might limit the field of inquiry. During an unstructured interview the researcher might start the conversation with a question and then actively listens to the respondent who talks freely (Bryman and Bell, 2007). The semi-structured interview involves the use of a checklist of issues and questions that the researcher wishes to cover during the session (Darmer, 1995; Bryman and Bell, 2007).

The semi-structured interview technique was used for data collection in this study. In qualitative research, it is important that the research subjects are given the chance to tell their own stories in their own words. Thus, one reason for using this technique of data collection is to encourage the participants especially the female science students to freely discuss their own opinion on what is causing the low participation of girls in science and mathematics. This method with open-ended questions allowed me to adjust the questions depending on the responses given by each participant but without deviating from the main theme and questions being explored. According to Darmer (1995) the semi-structured interview is neither a free conversation nor a highly structured questionnaire. The semi-structure interviews provide the opportunity to regulate the order of the questions and the participants have the possibility to expand their ideas and give detail in formations about diverse subjects rather than relying only on concepts and questions defined in advance of the interview (Kvale and Brinkmann,2009)). Using this method, I was able to reverse the order of some of the questions and where possible add some more questions based on the context and responses given by the

participants. Despite the advantages of the semi-structured interview is not without limitations. First of all, interviews are time-consuming. This weakness was overcome in the fieldwork by keeping the interviews to a reasonable time limit. Care was taken not to prolong each interview. Each interview was planned to last between 30 and 45 minutes. Also to avoid wasting time appointment for interviews with teachers and officials of the Girls Education Unit and the Science and Mathematics Clinics were was made and agreed time was scheduled which was religiously kept by the researcher. In some cases, I have to reschedule some the interviews with the female science students and teachers due to the fact on some of the days for the interview days some of the female students would be having lessons, the science teachers were also sometime busy teaching or engaged in some school duties.

Another challenge with qualitative interview is interviewer effect. This occurs when participants become self-conscious because of the presence of the interviewer. This can make some of the participants to either exaggerate, become afraid or inhibitive. The researcher using various strategies overcame this problem. First, I assured all the participants about the confidentiality of the study and also the fact that the research was intended for academic purpose only. Students who were inhibitive from the initial stages of the interview were assured of the anonymity of the study participants. Freire (2005) noted that some teachers are not confident and so tend to panic at the presence of other official and researchers, in order to deal with this, the teachers were also assured that the researcher was not intruding into the activities of the school or investigating them but rather undertaking a study whose result could help improve the teaching of science in the various senior high schools in Ghana. The interviews were conducted in the two selected schools in the case of the teachers and female science students whilst the interviews for the officials from the Girls Education Unit and the science technology mathematic education clinic' took place at their respective offices. Each interview began with some preliminary remarks to create a relaxed atmosphere and a trusting relationship. The respondents were informed of the necessity to make audiotape recordings of the interview but at the same time guaranteed that these would be destroyed after the dissertation had been written and finalised. To this end, the interviews were generally audiotaped but field notes were also taken. I began each interview by introducing myself, and giving the participants a brief idea about what the study was about so that they could have a grasp of the topics the interview would cover. After this and a brief introduction, I began the actual interview with questions, which focused on the study of science, asking them what they

think about it and what they career aspiration was. This was done to allow the participants to warm up and feel at ease through at the rest of the interview process.
The interview method was face-to-face. This is an interview structure in which the researcher meets one informant. Such an interview is easy to arrange as only two persons' time needs to coincide and the views expressed throughout the interview is from a single source, that of the interviewee. A one-to-one face interview is more easily controlled as the researcher has just one person's views and ideas to grasp and questions only one person during the interview.

Three separate interviews guide were used, one each for students, teachers and officials. The interviews explored various areas of girls' participation in science, technology and mathematics and how school culture plays a major role in this. During the interview warming, remarks were used to make the participants especially the girls' feel at ease to express their views. In some case, I reworded or repeated the questions so as to get the correct answer from the participants. In other cases I intentional repeated the answers given by the participants to make sure of what they actually said was true. To ensure accuracy in the case of audiotaped interviews and pictures were taken, the tapes were played back after transcription to make sure that these were verbatim records rather than subjective interpretations.

3.5.2 Observation

The semi-structured interviews were supplemented with observations. An observation is an important supplementary technique for research that is based on interviews, where the researcher makes notes on observable behaviours of participants at the research site (Creswell, 2014, p.190). It can guide the interviewer in the process, helping to inform which questions may need further exploration when it might be helpful to encourage the participant or when to abandon a line of questioning (Creswell, 2014).
There are different types of observation such as complete participant observation, participation observation and non-participant observation. The researcher use non-participant observation. This is the type of observation in which the researcher does not get involved in the setting but keeps aloof from the events and the setting and the participants become habituated to the repeated presence of the observer in the setting (Creswell, 2014)). Good non-participant observation demands that considerable fieldwork should be carried out in the setting, and that the researcher establish a certain rapport and trust with participants so that data generation can occur with minimum disruption in the setting and be recorded in the form of rich description.

Using this method, I walked round the schools, which I was studying with permission from the school authorities to observe the school environments without the aid of any teacher or student. This allowed me to take a look at the school facilities such as classrooms, laboratories, hostels, libraries, parks and dining halls among others. This allowed me to gain the trust of the headmasters and the headmistresses as well as the students. I was also allowed by the headmasters, headmistress, head of science departments and the science teachers to sit in the classrooms during science lessons. In each school whenever I am going into the classroom for the first time the Head of the Science Department introduces me to the science teachers and was given a place to sit in the classroom. This allowed me to observe the teaching style of the teachers, the learning style of the students, the interaction between teachers and boys, between teachers and girls and between boys and girls in the classroom. I also observed the nature of the sitting arrangement, the learning and teaching materials used by their teachers and critical girl-related incidents such as their engagement or non-engagement by the teachers. I made sure that I never interfered in any of the science lessons I observed even though two teachers sometimes sought my views. I maintained a certain detachment from the lessons by not getting involved in the way the lessons were being handled, the way questions were answered and the treatment of students by teachers, nor asked a question or suggest an answer. As a result of the detachment I maintained there was no problem for me going native in the school environment. In each school I spent a five days doing the non-participant observation. I wrote down my observation every five minutes. The field notes helped me to categorize some of the events and classrooms interactions into themes as the observation process continued. In this way events were recorded as they happened in their natural setting by the researchers without interfering. At the end of the day I would read over the field notes, interpret them and write analytic memos. This allowed me to plan my time and look out for anything that needed special attention.

This non-participant type of observation was well situated for this study because it would be very difficult for me to act in a covert fashion, in part because the headmasters, the headmistresses, the teachers and the students knew my role. This method offered me the opportunity of looking at what is taking place in the situation rather than at second hand. It allowed me to see things that might otherwise be unconsciously missed, and to discover things that interviewees might not freely say in the interview. (Creswell, 2014).

Despite the importance of the observation method, it has some disadvantages. Such as interviews, observations are also time consuming. This problem was overcome by taking the field notes of all the observations pertinent to the study. Secondly, as Creswell (2014) noted, the observer may make some erroneous inferences from observations. Some events may be mistakenly reported or interpreted, as they might be susceptible to observer bias. Also, an observer may select some events to observe and overlook others that are equally important. In the third place, the presence of a researcher in a setting may affect the behavior of the participants (ibid, p.191). The weakness of this aspect is that students could pretend and change their behaviour or attitude since they knew there was an observer. This is in line with Patton's argument that "people may behave quite differently when they know they are being observed" (Patton, 1990 p. 109). I took care to ensure that I remained silent in the classrooms, made no suggestions or interfered in the classrooms lessons throughout the observation period. Considering the limitations on both interview and observation methods, I realized using and depending on these methods could not provide deeper and enough information hence the need for the use of document for detailed study.

3.6.3. Documents

The use of documents were employed and these were collected from various institution visited in respect to the study. Hammersley and Atkinton (2007, p.122) assert that the use of documents provides an "insight of information about the setting being studied". As a result this method of collecting data was used for broader information about the study. Bryman (2008, p.389) mentions, the use of official documents deriving from the state can be authentic and have meaning that is comprehensible to the researcher. In view of that I made sure to obtain official data on strategic plan from the Girls Education Unit (GEU). This document entails the strategies put in place by the government of Ghana to improve enrolment and retention in schools as well as policies to improve and sustain girls' participation in STME Also the use and the analyses of the national and the selected schools (government and the government schools) provided an elaborative and in- depth picture on how gender inequality exists in STME subjects. This revealed the evidence to support the review of the issues raised regarding gender and science education. The official policies documents have been very useful in this study because of it stability (Merriam, 1998).

Unlike interviews and observation, the presence of a detective for instance investigators do not alter what is documented. Well, irrespective of the insufficient the document information might be, the relevant information obtained has been indeed useful for deeper understanding of the issues circulating gender inequality in science programme in the senior high schools in Ghana.

3.7 Validity and Reliability

Bryman (2012) stated that validity is an essential element; therefore the researcher should attempt to accurately represent findings. This depends on credibility, which can be enhanced through triangulation of data (Patton, 2002; Bryman, 2008). This was achieved by combining various data collection strategies, namely interviews and observation to collect data from three groups of people: Female science students, teachers and officials of the Girls Education Unit and the Science and Mathematics Clinic. Triangulation involves the use of two or more methods of data collection to study the observed phenomena from more than one standpoint (Bryman, 2008). In this study, three methods of triangulation were used at various stages of the study. Using semi-structured interviews and observation to study the phenomenon under investigation pursued Method triangulation. Whilst observations allowed researchers to study people's behaviour in 'real life' situations such as classrooms (Chambliss and Schutt,209), interviews yield rich insights into people's experiences, thoughts, views, opinions, values, aspirations, feelings, prejudices, attitudes and life stories (Kvale and Brinkmann,2009)). Interviews allow the researcher to interact with people, to talk to them, to listen to them and gain access to their real life experiences.

Data triangulation was used by using primary and secondary data sources; Yin (2003) observed that triangulation is a powerful way of demonstrating concurrent and participants' validity, particularly in qualitative research. Multiple sources of data aim at corroborating the same fact or phenomenon and case studies using multiple sources of evidence tend to be viewed to be of high quality (Creswell, 2014; Yin, 2003). The system of triangulation at the source of data, collection level and interpretation of each research question can enhance the credibility, transferability, dependability and conformability aspects of a piece of resource (Denzin and Lincoln, 2000). The use of triangulation was further informed by the two more reasons. First in situations where human beings interact, a single method may only provide a limited view of human behaviour and of situations. Multiple methods can be used to triangulate; certain aspects provided by one method may complement data obtained by other

methods (Bryman, 2008; Creswell, 2014). Thus, as argued by McIntyre (1999) the term triangulation describes a growing family of approaches and methods combined so that the strength of one method overshadows the weakness of another method thereby creating a balanced situation. Secondly, research methods act as filters through which we can selectively experience the environment; therefore, they can never be entirely authentic or neutral in representing the world of experience (Smith, 1975). So, the researcher's picture of the particular portion of reality under investigation may be distorted by the exclusive use of one method. Therefore various data collection methods were triangulated so that it will enable the researcher to assess the validity and reliability of the data (Yin, 2009). Validity is also hard to achieve using qualitative interview due to the presence of the researcher and the context of the study. The researcher overcame this obstacle by the process of triangulation by combining two methods of data collection namely interviews and observation.

3.8 Data Analysis

The analysis was based on the objectives of the study. Qualitative analysis was done by listening to the taped interviews and reading the field notes several times. During such time, themes were first derived, changes in meaning and specifying constituent units of meaning were noted and irrelevant repetitions eliminated. In addition to this, data obtained was also analyzed as and when they were available from the field. As Merriam (1998) states, "the right way to analyze data in a qualitative study is to do it simultaneously with data collection. The final product is shaped by the data that are collected and the analysis that accompanies this entire process" (p. 162).

The qualitative analysis was also guided by Creswell's admonition that, the general pattern of understanding qualitative work emerges when broad themes are developed and coalesced into a grounded theory of broad interpretations (Creswell 2014; Creswell, 2003). Going by this, the analysis of the data took the form of retelling the story of the participants with specific emphasis on significant statements that had bearing on the central thesis of the study and its objectives. The researcher did several reading of field notes, interviews and comments and re-examined the categories, and then, allocated pseudonyms to each participant's responses to the interview questions, noting similarities and differences. The aim was to create different concepts and to determine how they are linked. This, then, made it easier to trace the source

of each response and quotes. This was followed by cross case analysis of the interview, noting similarities and differences across participants' responses to the interview guide. Themes were developed from the data.

3.9 Research Ethics

All research involves ethical issues and this study is no exception. For this reasons extreme care was taken to observe all the ethics involved in research. I firstly went to the ministry of education to receive a permission letter which gave me access to the school. On entering the school, I went to the heads of the school who were my gate keepers (Bryman, 2008). I explained the purpose of the research to all the participants. After this, I obtained informed consent from the heads of the schools, the teachers and female students. Permission to conduct the study was obtained from the heads of the schools in the form of written consent. After that, I sought the permission of each of the participants to be interview by explaining to them what the study was all about and asked them to participate. I also assured them that there will be no risk involved in participating in the study and that they have the right to withdraw from the interview if they wish. The consent of the interviewees was requested before an interview was done. The purpose of the study was explained to the participants and they were assured of confidentiality of the information they were to give. Also the issue of anonymity was explained to participants that they would remain anonymous in that their real names would not be used in the study rather pseudonyms would be assigned to them. I also made them aware that the information given by them would be treated with outmost confidentiality and that at no stage of the research would the information given be used except for the purpose of the final thesis.

4 CHAPTER FOUR: PRESENTATION OF FINDINGS

4.1 Introduction

This chapter presents findings emerging from the study on how school culture affects girls' participation in science. Findings were from science students at the second and third year respectively as they have been in the school for two or three years and are familiar with the culture of the school, science teachers who were also heads of science department and an educationist who was a former science teacher from the Ghana Education Service. The findings are organised into five main sections namely relevance of science, teacher factor under which teachers attitude and teaching method will be presented, school policy/ school rule and lastly school facilities.

This section gives, enrolments, and statistics of male and female students and the number of teaching staff from the various schools. As the purpose of the study was to investigate and find out how schools culture affect girls participation in science students offering science in public and government assisted were interviewed to find out how the cultures of these schools influence (positively or negatively) their participation in science. From all the four the schools it was found out that there are more boys in science programmes than girls though enrolments at these schools varies. Considering the enrolment pattern from 2012 from all the four schools, boys constitute about sixty- five percent of the total population of science student of the school.

However, there are variations as there are more girls in the government-assisted schools than the public schools visited. The distribution of tables with figures showing the statistics on the number of student enrolment into science from the various schools are also presented for a clearer understanding. The first and second tables present the number of final year students participating in science from 2010 to 2014. Tables four and five also indicate the number of girls who are still pursuing science in the final year. Statistics on staff enrolment are also shown.

The study based mainly on primary data sources such as interviews and classroom observations and some secondary data in the form of reports and policy documents from Ghana Education Service (GES) for the analysis the following findings were obtained.

4.2 Relevance of science

This section presents the views of students on the relevance of science. For the purpose of clarity, the section will begin with the views from the government-assisted school (mission schools) and represent them with the "WH" and the public schools will be represented with "AL". The views presented are those from the second and third (final) year students studying science. These students are studying science as their major programme as electives and core. Numbers (i), (ii) up to (iv) were assigned to participants.

4.2.1. Students views on relevance of science from school ('WH')

When science students from schools 'WH' were asked on the relevance of science to them, they all responded affirmatively and mentioned that science is very important as it is expressed in our daily lives. A third year student from school 'W' indicated that" science is very important and that females participation in science will help in efficient management of the environment, malnutrition and control minor disease that claim lives of infants" (2nd October 2014). A second year student from school 'H' also stated that" science helps one to understand the nature of human development in general" (2nd October 2014).

A third year students view from school 'W' on the relevance of science she exclaimed "though science is quite difficult, studying science broadens ones knowledge and understanding, it is the only subject stimulate and challenged the way we think" (3rd October 2014).The views expressed by these female science students from the government assisted schools underscore the importance of science to all genders and especially the girls and women.

4.2.2. Students views on relevance of science from school ('AL')

Views on the relevance of science from schools 'AL' were expressed on the economic benefit of science to women and girls. A third year from school 'L' mentioned that "girl's participation in science will help them access jobs such as nursing, pharmacy and medical doctor". She further stated that" you don't struggle to get jobs from these fields as the world's population continues to increase". However views from these schools acknowledge that science is very difficult and very challenging. A second year student from school 'A' acknowledged" science is actually a difficult subject though useful to society". She further explained that "I find it difficult to understand physics because of the calculations involved

but I will try because I want to be a midwife" (8th October 2014). The views expressed by the students form schools 'AL' also add to the relevance of science in society although they accepted that they are facing difficulty in their physics classes.

However, a second year (iii) mentioned that she did not choose science because she knew science is difficult and so she did not want to do it, she was selected by the computer selection system. A third year student revealed that the pater father insisted that she should do the science "I never want to do science because it is difficult but I have to please him".

In summary, the entire student agreed that science is relevant; most mentioned it relevant and interesting because of its usefulness to the individual and the society. It is relevant because it helps one understand nature and so put one in a better position take of it. The interesting aspect of science lies in the fact that science is very practical. They also acknowledge that science is broad in scope and this makes it difficult with a special emphasis on the physic.

4.2.3. Teachers views on relevance of science

Teachers view on the relevance of science in all schools visited were the same, they all believe that girls need to be encourage to participate in science just as the boys because they form the largest number of the nation's population to enable them to access jobs in the field of science as well as for the efficient management of the environment. One head of science department from school 'L' stated:

> Science is very, very important to all especially the girls; I do everything within my capacity as a science teacher for the past five years to encourage the girls to take science as their elective because it will help them secure jobs, and even if they decide to change carrier their knowledge in science will help solve most of the environmental challenges we are facing in the nation's capital.

He further explained, "I agree with Kofi Annan when he said when women and girls participate in science, maternal mortality will be reduced to the barest minimum". These views expressed by the teachers 'shows how relevant science is for the individual girls and the society at large.

In conclusion views expressed by teacher on the relevance of science confirmed that the relevance of science transcends the individual girls to solving the environmental problems facing society.

4.3 Students views teachers' attitude from schools 'WH'

This section presents the views of students on teachers' attitude in the classroom as the schools micro culture. It reveals the kind of interactions that goes on between teachers and students during the teaching and learning processes. A classroom observation conducted during a visit to school 'W' during instructional time demonstrated how some of the teachers are making effort to help the female student in their class keep up their pace with the boys. Questions were evenly distributed and girls led a demonstrated lesson on acid testing. As revealed by a third year science student (i):

> Our teachers in this school do not discriminate, we are all treated equally as you just saw. Questions are evenly distributed and if am not careful I may say we the girls are favoured most. The biology class is the warmest though other subject teachers are also doing their best.

This is quite different from the popular findings from various studies that build up the assumption that teachers attitudes portrayed during science lesson tend to discourage girls from participating in science. A chemistry and biology lessons also observed from 'W' indicated that boys and girls are equally engaged in the class; questions are evenly distributed. Favorable remarks are given to deserving students though the boys outnumber the girls in the class.

A third year student (ii) from science three mentioned that" physics though challenging is her favourite because of the way the teacher handles the subject". She explained further that" even when you make mistakes the kind of words he uses make you feel like trying again"**.** As a result, by way of performance in terms of ratio is 3:2 as physics has been identified by most of the girls as the most difficult of the entire science subject. A further question on the difficulty expressed for physics revealed that it is because it involves mathematics and so when ones foundation in mathematics is not strong one struggles in physics.

On the contrary, views and observation from school 'H' depicted a different picture. Teacher attitude toward girls at the science laboratory as I observed a biology and chemistry class was different. More attention was given to the boys than the girls; questions were not even

distributed as most the question were directed to the boys and the teacher spent more time by the desks of the boys discussing their work with them and spend less time by the desks of the girls. As revealed by a second year student (i):

> Though the teachers are good, their lessons are directed to one side of the class so we hardly hear them when they are teaching their questions are not evenly distributed. Also their teachings are focused on the more brilliant ones who in their view are the boys.

This goes to support assertion that the teachers during their classroom interactions favour boys more than girls. This student further mentioned that the words used by some of the teacher on them during instructional time are so disheartening and sometimes change their sitting arrangement with girls on one side and boys on another side.

The attitude of the teachers from the two government assisted schools varied. However, at the two school students indicated that their teachers are hardworking and they do well to encourage girls to work hard and take up science to higher levels. But some act on the contrary as one student from school 'W' stated that a teacher told her "you are not meant for this class, what you are doing here, you should have been in the home economics class and not the science class. Science is for serious minded people". Such comment from a teacher does not encourage girls and make them feel insecure in science class. It also has the tendency of reducing their interest in science.

4.4 Teachers attitude from schools 'AL"

Teachers attitude towards the student from schools "AL" are not too different from those from schools "AL". From the school's observations made from the laboratory and classroom during instructional hours are that the girls are treated equally as the boys. They are all given equal chances to participate in the teaching and learning processes. An interview with a third year student (i) from schools" indicated as she praised her biology teacher:

> For this school as long as the computer select you to do science most of the teachers especially the biology teacher will go the extra mile for you. He always gives us assignments to take home and practice to make us have an upper hand and also motivates us with good words to work hard.

This shows that some of the teachers attitudes towards the girls are positive and encouraging as boys and girls are given equal attention by my observation and what the respondent

themselves are saying. The positive attitude of the teachers according to this respondent has created a healthy relationship between girls and boys. She further stated emphatically “this school has a way of making science attractive to every student selected to do science here”.

However, within the same school, a second year student (iii) expressed a different opinion. She stated that “though they seem to treat us equally, the negative words used by some of them are quite worrying”. They use words like why are you here; do you think you are supposed to be here”? She explained that such comment have caused some mate to change their programmes to general arts and business. Some of the students are of the view that some of their teachers easily give up on them anytime they do not perform in mid-term exams and begin to question how they made it to the secondary school.

In a similar vein, second year student revealed that the teachers attitude towards the girls in their science class is on friendly. She mentioned, “They claim they want us to learn and so they sometimes use harsh words on us”. Asking her the effect of the harsh words on her she indicated “it makes us fear them, we are rather intimidated and cannot contribute in class, and sometimes I feel unwanted”. According to one student from school “L”,” the female teachers are very kind and treat us well but unfortunately they are few. Out of the nine teachers who teaches science, only three are female and recently one is gone abroad.”

The attitudes of teachers towards the girls from the four schools visited shows that most of the teachers are doing their best to encourage the girls who are offering science programs to do their best. Whiles others work hard to maintain the girls in science, some others by their negative attitude have sent some out of the class and intimidate the few left which according to one second year student (i) from school “A” this consequently affect their performance.

4.5 Teaching Methods

This section presents the views of teachers on the teaching styles of teacher from the four schools visited in this study on the influence of school culture on girls' participation in sciences

It captures the various teaching styles used by science teacher during instructional hours.

4.5.1 Students views on teachers teaching styles from schools "WH".

From the four schools observations were made on teachers teaching styles and, teachers also expressed the views on the teaching styles adopted in teaching. A classroom observation conducted during an instructional time demonstrated how most of the teacher use lecture method to teach science. One student (IV) form school "W" lamented "the way the physics teacher teaches is bad, he always write on the board and give us long notes to copy note we sometimes don't understand and so I don't like physics". She further added that they hardly go for practical lessons.

Science is more practical and demands a lot of practical lessons and so teaching science using lecture method will make the lesson boring and confusing to student. In the words of one student (iii) from school "H""I dislike physics and don't go to the class because it is boring and I always feel like sleeping "In her view sometimes they don't even understand some of the terminologies on the board.

There is the assumption that a teacher teaching method can affect the teaching and learning processes and how lessons are assimilated by student in most subject areas especially science and mathematics. Again group work has also been identified as very effective in the teaching and learning processes however a classroom observation during instructional time revealed that group work is not encouraged during a chemistry lesson at school "H". In the view of one second year student (ii) "most of the teachers think we the girls are good for nothing and so during mathematics class they group boys at one side and girls also on one side because they think the boys are better than us".

At the same school, a third year student revealed that their biology teacher put them in groups to work most of the time. But added that other do not do that they prefer to lecture and blame it on the limited facilities at the science laboratory. However, at school "W" a final year student indicated that their biology mistress has her practical lessons science laboratory and

sometimes theoretical lessons are also done there. She added that "her lessons are interesting, she use power points, projectors, and a lot of teaching materials". In her view this makes us remember most of the things thought as the lessons are not so abstract but more practical.

4.5.2 Students view on teachers teaching method from schools "AL".

Teachers teaching methods at schools "AL" were not different from that of schools "WH". Most of the teachers were not using learner centered method such as discovery and explorative methods; rather most were addicted to the old lecture methods blaming it on the inadequate to lack of teaching learning materials. An observation made during an instructional hour at school 'A' from two lessons revealed that the teachers' main method of teaching is lecturing and copying of notes prepared by the teacher. I also observed from school's' that the teacher in his absence gave notes to the class prefect to dictate for the colleagues to copy. During this time some of the student left to go and buy food. According to a second year students their mathematics teacher teaches abstractly without using teaching learning material. In her word words she indicated:" it is not that we girls don't know mathematics but the way the teacher is teaching it". A similar incident was revealed at school 'L' when a third year student also described the attitude of the elective mathematics teacher." He always talks about formular but does not explain them well and elective mathematics is very important". As school 'A' and 'L' have computer laboratory and technology is very vital tool in teaching and learning in contemporary societies but during an instructional hour, I observed at school 'A' that teacher were not using any of modern technology during teaching and learning process. However, an interview with a third year student revealed that though the teacher do not use projectors and other forms of technology in teaching they encouraged them to form online study groups with students from other schools so they could share ideas.

4.5.3 Teachers view on teachers' attitude and teaching methods

The opinion of the heads of science department of the schools visited were sought to find out what they think about the attitudes and teaching methods of their teachers at the department toward the girls offering science programmes. These teachers happened to also teach some of the science courses. From a classroom observation during teaching and learning process, I observed that boys and girls were treated equally as questions were evenly distributed and where girls are not confident enough, they were given chance to try till they get it. As in the words of a male biology teacher from school "H" "some of the girls themselves are not

confident but we keep on encouraging them to keep trying and as result some are now doing better ".

A further question to find out whether all of them encourage the girls, he indicated; "no all of us are not the same we have cases where some colleagues cannot cope with the dull ones and this they do to boys as well; our attitudes are not the same. Some find it difficult to relate theory to practical and it's a problem but I keep talking to them.

A female teacher from school "W" mentioned that a male teacher once had a problem with the girls and the girl wanted to leave the class as she felt the teacher hate her because of the harsh words he uses to address her in class. In her view, some of these attitudes of the teachers are rooted in the hegemonic nature of the Ghanaian culture but they hope to overcome it.

4.5.4 Educationist view on teacher's attitude and teaching methods

The view of an educationist was sought on teachers' attitude and teaching methods. She acknowledges that they have problems with the way the science teachers are handling the subject using lecture method sometimes. She however mentioned that it depends on the type of school. Some schools in her view have very good science teachers who knows how to improvise where there are no materials: she stated "some teachers are good and have command over their subject matter other don't and so put their frustration on the student and mostly the girls because you can do that to the boys, you know our culture and how it affect us." She indicated that they take them through several refresher courses to equip them on current methods of teaching but some of these attitudes of not treating girls fairly has its roots in our culture but these varies from school to school.

Asked how regular they do supervision to check on teachers' attitude from the science unit of education, She explained that there is a regular check but he problem is that most of the teachers at the senior high schools have master's degree while most of these officer do not have such degrees: they rose through the ranks as a result on the field they are intimidated by these master degree teachers. Again in her view their major challenge is the attitude of physics teacher as some of them do not want to use the instructional hours claiming it not sufficient for them. However she added that her outfit is working had to get the right team for effective supervision work.

4.6 School policy and prohibitive rules

Policies that are run in schools are set from the national government, and as Kabeer(2008) noted policies and rule are set at national levels plays out at the institutional(school) level to exclude other from participating equally with other. However, at the school level these policies are reshaped to suit local (school) context. They are influenced by rule, norms and values at the local level. This leads to variations in school cultures. Whiles some school remold national policies to aid the smooth running of the school to suit the local context, other operate with the national policy without interference. The school visited in this study varies in their cultures. This section present view from participant in the study on how national policy and school rules affect girls' participation mostly in science.

4.6.1 Students view on school policy and rules from school "WH"

Student selections into programmes at the senior high school are based on computer selection system where they are selected based on performance. Once you are selected for a programme that is what you are expected to do at the school, some schools however do not follow this national policy and rules rigidly, in the view of a third year student (i) from school "W" on the computer selection into programmes she narrated:

> I was not selected to do science, the computer selected for general art but when I came the headmistress told me they have no vacancy in general arts but science. As my initial aim was to do the science but was not selected to do the science, I took the challenge and told my father I can do it and so that is how I became a science student.

This girl though she desire to do science by the computer selection system, she was denied access but the school has a policy of giving the student after the selection system at the national level the opportunity to choose again. Asking her how she is faring in the science class she confidently explained "I am doing very well, I was the overall best student at the just end mid-term exams for the third year students and working had to maintain at the final exams." The policy of the school has put this student on her desired career path.

Other schools however do not give such opportunities to students for them once you are selected into a programme that is what you are to do. No chance is given to any student to change. Contrary to the view from school "W", at school "H" no such opportunities are given to any student once you are placed by the computer selection into any programme that

becomes your lot. According to a second year student (IV) some of her friends wish they are in the science class because they want to become nurse but they were not selected. They have been given programmes they are not really interested that they have to manage and do it. A second year student (i) one had a different opinion she stated empathically " I have been selected and though I cannot change it and my father would not allow me, some of my friend who want to do the science have left to other schools to repeat the class to do the science and vice versa". Some students who insist on doing the science but for strict adherence to national policy have to leave to other schools that have flexible rules to pursue their dreams. Asking one third year student why their school do not give them the chance to swap programmes she stated" I really don't know, maybe they do not want problem from Ghana Education Service or the authorities involved". This startling revelation of how computer selection programmes is denying student the opportunity to access programme of their choice is quite worrying.

4.6.2 Students views from schools "AL"

Information gathered from schools AL is not different from what pertains at school H above. These schools rigidly follow the computer placement system as such no chance is given to any student to reselect any programme of their choice. A second year female student (iii) form school "A" whose expectations are not met in the science class could not hide her frustration as she stated "I never choose science it is the computer placement and now I don't know", she further indicated that some of the girls really want to do the science and wished she could change with one of them but the school will not allow her

Again, at school 'L' most of the girls interviewed mentioned that they were selected by the computer placement system and would have chosen a different course if they were to choose themselves. However a third year student mentioned that though she was selected she is happy she is a science student and will want to pursue science to the tertiary level. Also a third year student revealed that her cousin who loves to do science was not chosen because of the choice of school. She explained "'she choose Wesley girls high school but was sent to another school and was denied the opportunity but with the same mark I am offering science here, the system is not fair placing people where they do not want '".This then indicates that the selection does not only affect their participation but also the school of their choice.

At school ‘A’ a second and third year also confirmed that the computer placement did not favour them. They added that although they intend to offer science they are not comfortable with the current subject combination at the current school. They explained that they want to do medicine but their current combination is taking them to the hard science (physics agricultural science, agricultural engineering), a field they are not interested in. This startle revelation on subject combination was a challenge for most of the girls at the two schools. As a result one of the students indicated that after school she will divert to go into business programme.

In summary, these section has taken the views of respondent on how their schools handles their selection into the science programmes and views expressed indicate that some schools are able to adjust the national policy on the computer selection system making way for more student to participate in science programs which according to one girl, has given her the opportunity to prove her abilities in the science class emerging the overall best. Quite on the contrary as culture differ other schools have no such arrangement denying student and mostly girls the opportunity to participate in science as by observation and statistics from enrolment shows that boys out number girls in science at the schools visited.

4.6.3 Teachers view on school policy and prohibitive rules.

This section present the views of heads of school and heads of science department of the school visited in this study. The heads and their staff are the custodians of the rules and values of the schools and they inculcate and operate with this rules and values as they interact with student on daily basis. Again they implement the policies that are formulated by the policy maker to suit their environments or the culture in which the schools are situated. However, the implementation of set policy in schools varies some make changes to suit their local needs whiles other schools,’’ rules are rigidly followed”.

According to the headmistress of school “W” they have a way of allowing students who want to change their subject to that which they can be comfortable with to do so. She stated “it is the policy of this school to have good number of girls and boys in all programmes especially science, home economics and visual arts which usually the gender skewed to one direction.”

She further explained that when they come for the first, "we give chance to them to reselect the program of their choice especially the science.

When asked the reason for this decision, in her sometimes the students selected by the computer do not do well and those who joined rather as the school gives them the chance perform better. Asked whether she trust the computer placement system she answered yes but believe that sometimes we must not rely totally on that and from experience what they are doing help enroll some girls into science.

On the contrary, schools H, A and L do not give such opportunities to their student, they have a different. For them once you are selected then it means you are qualified to do the science so whatever programme you are placed in by the computer placement system they make sure you are there to do just that.

The views from these schools are different just as culture varies from place and society to society. Whiles one school believes student must be given more than one chance to decide on what program to pursue, others do not and so this can to some extend affect their participation in programs available at the school including science.

4.6.4 Schools prohibitive rules

Students views on schools prohibitive rules from Schools "W, H, A and L"

These section present views on school prohibitive rule in this other because two of the visited schools are day schools without boarding facilities. And the challenges gathered from respondent are similar. Schools W and L runs day and boarding for their students whiles schools A and H are purely day schools and so when school closes all school facilities are closed down. From my observation as I spend a day there with the student, the school closes at 3: pm and all buildings are closed including school library and science laboratory. As stated by one second year female student (IV):

> as soon as the school close they close every place and so we don't have anywhere to sit a do further studies, you know doing science, you need a lot of time alone. When I get home as the only girl in the family I have to help my mother to prepare the evening meal so I don't get time to revise. If the library or science lab is available I can stay to study before I get home and do my assignment but it's closed.

This view expressed by the student was confirmed the head of science department who also indicated that it affect the girls because at home most of them do not get the time to revise and do their assignment. The rule that operates in the school according to the science teacher was an order from above that they have to follow so they will not have problems. The view expressed by the female student was confirmed by the head of science department. The same rule also operates at school "H". However, though there is a rule banning the use of school facility after instructional hour, at school "H" a second year student (iiii) revealed that their physics practical lessons are held on Saturdays in the schools premises at an extra fee. She lamented that this affects most of the girls. She explained that they are affected because they help their parent on Saturday and most of them help at the shop.

At schools "W and L" a similar picture is depicted from a different angle. The girls at the boarding house mentioned that they are forced to have siesta, a time that in their view could use be at the science laboratory, ICT laboratory or the library which closes at 4: pm. A third year student (ii) from school "L "lamented, "the boys are not under strict measures to obey and observe siesta but we do failure attracts punishment from the senior house mistresses". The student explained that this affect their studies as they don't get the needed time to revise and study on our own as science demands a lot of time. The boys have access to the library, laboratory and the computer laboratory after school because the siesta rule is not ridged on them; they could also meet to do group work and so gives them in edge over them in terms of performance.

Schools with strict adherence to policies and rules from the view of the female student affect them in their work and so to some of them this tend to affect their performance. The day students mentioned that they are denied access to the school study facilities after school and when they get home they are not able to do much as they are saddled with house chores. The boarders on the other hand are also bound with siesta rules and so at these visited schools science is seen as a programme that demands time, which to them is not available

Teacher views on school prohibitive rules

In most schools authoritative rules are to be obeyed by all staff when the rule is from higher authority such as the computer placement system and the bane on the use of school premises after school contact hours. According to one teacher as he from school "A" the bane on the

use of the school premises have affected them so much as the school time table is loaded with extra curriculum activities that eat into their time. This he stated “we use to help these girls who do not have self-confidence to do science after school but seen they said we should stop, we have to obey”. A female teacher from school “W” revealed that the after school extra classes help the girls a lot because when they get home they are not able to do enough like the boys because they have to help”.

In a similar vein the head of science department from school “L” also mentioned how the extra classes help the entire student especially the girls who do not normally have the time at home to do extra work. He revealed that: “though there is a ban on extra classes and the use of the school premises after school, we called a parent teacher association meeting and in agreement with the parent have the classes for the students and this has helped a lot.”

The heads of schools W and L also mentioned that their schools have a culture to help all who are admitted in the school to excel in whatever programme they are placed in and so do everything in collaboration with parents to help their students. The headmistress of school “W” who is also an old girl of the school mentioned that during contact hours they have class register to monitor the activities and movement of teachers so that contact hours are not wasted. She indicated that most of these class prefects who have the attendance book to monitor teachers’ movement and work are girls. This she explained further that “because of the rules set on the use of school premises we have to be smart and put things in place especially to help our girls who at home do not have much time.”

Educationist view on computer placement policy

This part presents the view of an education officer in charge of STME from the Greater Accra Metropolitan Assembly where these schools were selected for the study. According to her the computer selection system is good and fair to all genders. In her view, it is a means of addressing challenges associated with the formal mode of selection where students from elites homes access the grade A schools and other are not able to have access to such schools. She indicated, “this selection system is to equal selection of boys and girls into programmes and to make sure that everyone has equal chance to access any school of their choice. However ones selection is based on performance and no quota is allocated for girls.” In conclusion, different schools have a way of responding to rules set and also have different cultures that motivate

and sustain student interest in programmes chosen in general and specifically science. Whiles some schools religiously follow rules set by authorities to the detriment of students others have a way handling such rules that will fit into their own culture. Some schools are aware of the larger society culture at home that occupies the girls after school so have creatively put in place measures to help them.

4.7 School facilities

School facilities are necessary in the day to day running of schools .Facilities such as well-ventilated classroom and science laboratories, relevant books and specimens, computer laboratory and digital technologies are necessary tools for effective teaching.

4.7.1 Students view on school facilities.

Several studies conducted in Africa shows that most of the schools lack the necessary and required school facilities such as textbooks, computers, library and science laboratories, tables and chairs and so on. In this study through observation during instructional time and as I was taken around by the heads of the science department at the school visited in this study, I observed that these assumptions were not far from the truth. Again the interview sections confirmed my observations with students and the teachers.

The data from schools W, A, H and L revealed that there are almost empty science laboratories without the needed facilities. The figure below shows a deplorable state of the science laboratory from school “W”

Figure 2A picture of a deplorable state of a Science Laboratory

In libraries where they seem to have books; these books are either or irrelevant. An interview with a third year student from school H indicated that although there is a library in her school, there are not enough books in the library and the books are very old and have no relevance to the topics that are taught in the science syllabus. In the words of the student:

> There are not enough books in the library and those that are there are so old. When you read them you can't even find the topics we are treating in them and when you do they are using different examples you have to go there with your own book to read.

Additionally, there are no enough chairs in the library so this discourages students who intend to use the library from do so. She "I sometime don't go there because you can't get a chair to sit on.

The schools though have science laboratories; they have facilities that are outdated. As in the words of a second year student from school Hour school does not also have a Science Resource Centre but have one science laboratory for Physics, Chemistry and Biology. Although the school is required to use the Science Resource Centre of the nearby school, the teachers have decided to use the one in all science laboratory". In another observation from school "A", the laboratory can be described as empty because it lacks some of the apparatus, samples, alcohol, bases and acids

Figure 3A picture of an empty science laboratory

The figure above shows the beautiful but empty state of the science lab which cannot promote hand –on experience learning. As admitted by this student "our teachers ask us to go and buy some of the things (materials) we need for the science practical if you don't bring it you will be sacked from the practical class." For instance this respondent is sometimes sacked from the biology class because as she said "I can't go and catch a mouse because I am afraid". Thus

a result of the lack of the materials for the science practicals some girls are denied access to practicals in the laboratories. She again explained that some of her friend hates science because according to them they said they couldn't go and search for live animals. The consequence is that these girls would fail and either drop out of school or opt for another course.

Additionally, the one in all science laboratories is very small so it cannot take a lot of student. My observation of a biology and chemistry practicals at the science laboratory at school H revealed that during the practicals in order to avoid overcrowding, students are put into groups of five and six to use the apparatus or materials putting five or six student into a group for a practicals seem too large which may not benefit others as they may not see clearly. There are also not enough chairs in the laboratory so the students have to bring their chairs to the laboratory anytime they have practical. This aspect of the science practicals puts some of the girls off. As admitted by this participant "I don't like the science practicals because you have to carry your own chairs to the lab and carry it back to the classroom. It makes me tired for the rest of the day so I can't concentrate in class". The science laboratory is also not spacious and happens to be the office of the head of science department where he also receives her visitors. During their visit, I observed they make so much noise to disturb the student during practical lessons.

The four schools have computer laboratories but these laboratories are not vibrant and most of the computers are not working. According to two students from schools A and H, they were not allowed to go to the computer laboratory in the first year and that has been the norm. A personal observation made during an informal conversation with the head of the computer laboratory at school L was that, only few girls were seen at the computer lab browsing. According to this teacher they have few computers and so they had to strategies and plan well for each class to benefit from the lab. A third year student at school'' W ''however mentioned that they are allowed to use the computer lab and in her word she said "I go to the ICT lab when we have lessons and after school because apart from our normal lessons there we are not supposed to go there unless after school because most people abuse the place". She further added that most of the girls are not interested in going there and for reasons known to them.

Science and technology go hand in hand but as per my observation and from the interviews most of the teachers do not use projectors, computer and modern technologies in teaching as they claim the schools do not have such facilities. On the contrary, at school W the female

biology teacher was mentioned by a second and third year student to be using the projector and other accessories donated by the parent teacher association (PTA) and old student to teach. She also comes to school with her own laptop to use during demonstration lessons. The third year student mentioned that using such teaching learning material makes the class lively. In her words she said “science is practical and living so using things like computers and projectors make it real to us we don’t have to imagine”.

4.7.2 Teachers views on school facilities.

Teachers’ views from the four schools were sought on the state of their school facilities as pertaining to teaching and learning. The four teachers all shared a common view on the state of school facilities in all the departments but they lamented their science department is most affected. Two of the schools science laboratory has no running water though the taps are there this means student have to fetch water before practical lesson and mostly eat into their time. At school H most of the specimens are overage and have most parts gone off. The figure below shows the picture of science lab from school” H” science lab

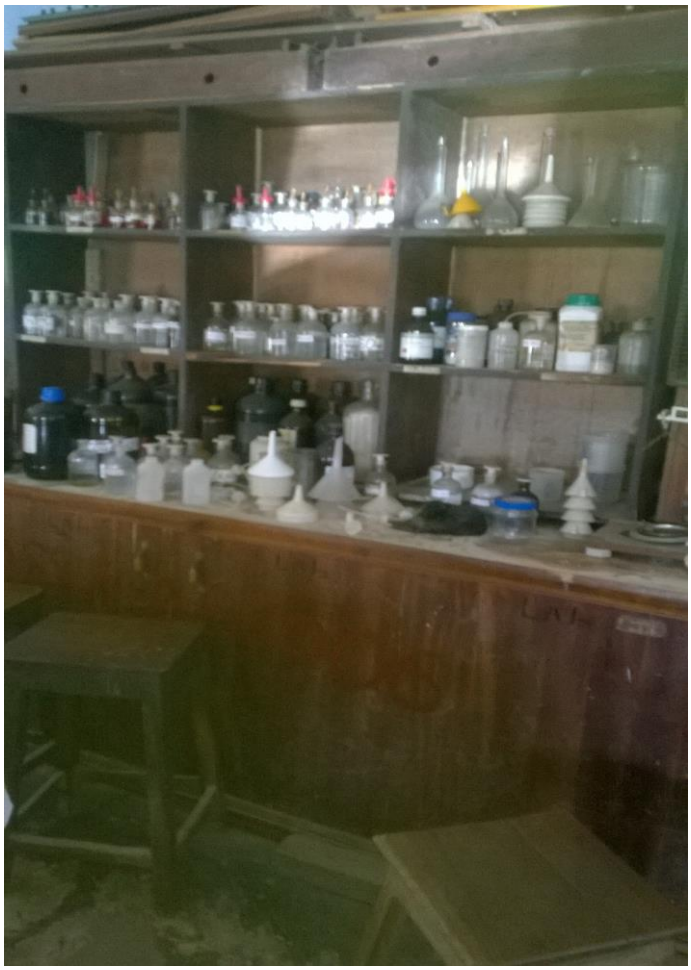

Figure 4A picture showing empty specimen bottles

In the words of the head of department, "sometimes we make them buy the chemicals like alcohols and bring insects to school because the school doesn't have it". This goes to confirm what one student mentioned earlier and added that most of the girls are not able to get the live animals and is a real problem, some too don't have money. Schools 'A' has three separate buildings for the three aspect of science but was almost empty.

Schools W and L seem to have most of the facilities but most are over age charts and maps are torn and mended with tapes. But the head of department at school L indicated that Ghana Education Service occasionally replaces them. The teachers all acknowledge that most of the science textbooks are outdated and somehow not gender responsive. They sometime are pushed to recommend those on the open market for student to buy. My observation at the school L library revealed that most of the books are really outdated, very foreign in terms of content and examples and printing of poor quality. An interview with the head of science

department at school L revealed that her experience as a science teacher at the school for the past twenty years has helped him compiled topics on all the three aspect of science using different text books and internet sources in a form pamphlets for the student which according to him has been very helpful. In his word he mentioned "government books lack substance they are not enough and we cannot depend on them so we use other sources and encourage them to read".

The lack of facilities is not unique to one school but some of the schools have a way of managing through the situations to have edge over others. Schools ''W and L''have a strong PTA backing and support from non-governmental organizations that sometimes help them with facilities.

Educationist view on school facilities

The government of Ghana through the Ministry of Education and its agency Ghana Education Service are responsible for furnishing public and government assisted school (mission schools) with resources such as textbooks, school buildings and all other resources needed for the smooth running of school and for effective teaching and learning and so the view of an education officer in charge of the science and mathematics, technology education was contacted and interview. According to her all schools are supplied with the needed facilities and based on the schools numerical strength. In her view most of the schools do not take good care of the facilities and so run short in no time. She revealed however that some of the schools are good and are well connected in their social network so they get extra help. In her words

" some of these schools are good especially the mission schools because they are supported by their churches, but in some cases some do not do well in fact some of our schools are also doing better than mission schools with all their traditional link with the mother church. In fact it depends on the head and the history of the school (Brock-Utne, 1990).

Her view is supported from the findings emerging from the data gathered from the four schools visited in this study. Schools 'W and H' are government assisted schools but findings revealed that school ''W'' which is a government assisted (mission school) seem to by its culture has strong social network support of the PTA and old students in their infrastructural

development as well as the attracting the kind of teacher and influencing other aspect of the schools life than school ‘’H’’ which is in the same category as school ‘’W’.

Comparing schools

The study aims at comparing cultures of schools and with the purpose of investigating and to find out how these cultures affect girls participation in science. This section attempts to compare with reference to the findings from the four schools, which school a culture that either attract girls into science than the other.

The four schools visited in this study all share similarity as well as have difference that make them unique. They all uses the national curriculum and write the national exams; again the government hires and pay the salaries of the teachers of these schools. Regionally the schools are all located in the same region. However these schools differ because ad their differences lies in the fact that schools ‘’ W and ’Hare influenced by the missions they represent. The missions have their education units in the same districts they are located and share in the governance of the schools. They to a larger extent determine who head the school at any given time as they have a culture of excellence and morality they want to preserve. Additionally they also support infrastructural development of such schools given them an edge over the other public schools and most of the time they fall into the category ‘’A’’ schools in terms of ranking those most of the public schools also falls in the same category.

The findings revealed that students and teachers believe science is very important and that girls participation is for the good of the girls and form the socio-economic development of the society and the head of department for science in school ‘’H’’ expressed the desire that they wish they have more girls participating in science at the school however, the school does not make room for the student to change programmes after the computer selection at the national level. School ‘’W’’ on the other hand has a policy that after the computer selection, fresh student are allowed to change their programme to any programme of their choice without waiting to repeat a class which give chances to some of the girls to have access to participate in science. The two other schools also give no chance for selection after the computer selection.

Again, the attitude of the teachers and the boys toward the girls in terms of motivation seem to also vary from one school to the other. At schools ‘’W, and L’ the students mentioned that

there exist a healthy relationship between the girls and the boys in the science class and also indicated there the boys motivate them to learn and do not call them names, they are put into groups to work together. As indicated by a third year student the first position is always competed for boy boys and girls and no one has the first position.

Meanwhile though there is a healthy relationship among the students in the science class, the same relationship does not exist among science students and their teachers; the interview with the student revealed that whiles most of the teachers are doing well to motivate and attract more girls into the science department few nuts among them keep scaring them. For instance two of the four girls interview mentioned that the physics teachers attitude seem to mock them anytime they did not do well in an interim assessment. But the interview clearly revealed that there teacher student relationship at school "W" compared to the three other schools is healthier and motivating.

A similar scenario was observed at school's' L a public school as the science girls mentioned that the attitude of the boys towards them is a healthy one; they do not look down on them or call them witches. Teachers' at this school were praised but the attitude of the physics and the mathematics teacher was a source of worry for the girls interviewed as they complained that they use lecture method to teach and so they find it difficult to grasp. The girls asserted that anytime a new student comes to the school to do science the old ones will tell them how these teacher make science difficult so it scare student especially girls.

Schools 'A and H' on the contrary gave a different scenario contrary to what was observed and gathered during the visited the girls complained about their teacher's attitude towards them. Out of the four student interviewed three revealed that the teacher attitude towards them makes them feel they have 'missed their way' and wish to change their programme. At school 'H' the girls complain about the physics teacher's attitude who takes advantage of lack of physics laboratory to fix his practical lessons on Saturdays which according to the girls is there day most of them help their parent at home or market. This class according to the girls is for a fee of which most of them cannot afford so they miss it and affect the performance. Most of them as they indicated have to engage in weekend trading for economic reasons.

A similar situation is reported at school 'A' but here there is no Saturday class but the some teachers are mentioned as mocking the girls and using negative word on them anytime they make mistakes. According to the girls some of these teachers tell them they are good for home economics class and not science, again they indicated that this attitude intimidated them

a lot and such signal is sent to other making science scary and' something for boys'. Further their teaching methods are outdated and very abstract though on student mentioned that their chemistry teacher encourages them to use the Internet they don't use it either. The teaching of science is separated from technology.

The attitude of physics teachers in all the visited schools was almost the same as they seem to scar and create the impression that science is an area for the tough who happens to be boys. This attitude of the physics teachers was confirmed by the educationist at the Ghana Education Service. She confirmed that they have had report and challenges of physics teacher, which in her view is a national challenge.

On school prohibitive rules and policy schools 'W and L' are day and boarding(lodging) school and here the science girls mentioned that the siesta rule hinder them from using the science and computer laboratories and the library which impede their work and sometime affect their performance. Such rules are not rigid on the boys and some have access to all these facilities which they lamented are not fair and wished something could be done.

Additionally, school's' has a policy that makes teachers accountable to the students and their parents According to one third year and second year students, they have a book which monitor the teacher activities in class in all the programmes at the school. The teachers sign this book at the end of each lesson in the presence of the class prefect who may be a boy a girl and so sometimes have their grievance addressed. These schools are presented to parents at their PTA meetings to address concerns raised by parent during such meeting. This policy was not found in the other three schools.

Again, in all the schools presented in this study, there are more teachers than female teacher and the few female teachers are all reported to be teaching biology and agricultural science while the majority of the male teachers teach the physics and chemistry. However the female teacher at school's" W" mentioned that she can and has handle chemistry before but due to other official assignments is has given it out.

The findings further revealed that all schools have infrastructural problems though it varies across the schools. For instance school W which is a government assisted school and school "H" which is a public school have separate science laboratory for physic, chemistry and biology, whiles school "H" which is also a government assisted school (a mission)school has

only one laboratory for all the aspects of science. School ‘A’ has buildings but without needed facilities that promote teaching and learning whiles school ‘L’ has most facilities though outdated.

Summary

In conclusion, this chapter present finding from respondents from the schools visited on how school cultures affect girls’ participation in science. Views were solicited from students, science teachers’ heads and an educations officer. The chapter was organized in into themes with subsections for the purpose of clarity. The first theme presented in this chapter was the views on the relevance of science; the teacher factor with sub sections such as teachers’ attitude and teaching method was presented. School policy and school rules were also presented and finally a comparative dimension was presented for the four schools.

The data gathered from the schools revealed several issues that affect students’ participation in science in general. However, as the aim of the study was to find out those factors within the school that affect girls’ participation in science, those pertaining to girls were considered in the presentation of the findings. The data revealed that all respondent in this study acknowledged that science is relevant for the individual and the society and as women are girls outnumber the men and boys, there is the need to encourage their participation in science at the school. Again, the teacher factor was also identified by the data as an element of the schools culture that either encourage or discourage the girls’ participation in science. Here the attitudes of the teachers can be categorized as motivators, mockers and extortioners. Some of the teachers through their interactions and during the teaching and learning processes motivator the girls and encourage them, whiles others by their attitude and words mock them. Others in a similar vein extort monies from them taking advantage of lack of facilities in the school.

Further, school rule, policy and infrastructure were also identified as elements with the culture of schools that affect participation of girls in science. The data however revealed that most of these rules were those emanating from the larger society, which is the ministry of education

5 CHAPTER FIVE: DISCUSSIONS AND CONCLUSION

5.1 Introduction

This chapter is in two sections, the first section discusses and analyses findings that emerged from the data as presented in chapter four. The discussion is based on the five main themes that emerged from the data; (1) the policy and school prohibitive rules, (2) the teachers' attitude, (3) the teaching style, (4) school facilities and lastly (5) the relevance of science The analysis is linked to the discussion of the findings from the field with some relevant theories selected in this study as the theoretical framework; critical pedagogy, cultural production and reproduction, and the right-based approach. The second section presents a conclusion on the thesis. The analysis will help the finding answer the research questions framed from the research objectives at the beginning of the study. Firstly the study will discuss findings on policy and school prohibitive rules related to the theoretical framework followed by the remaining categories.

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5.2 Policy and School prohibitive rule

This section presents discussions on policy and rules that emerged from the data collected from the visited schools

Policy

Policies and rules that govern schools are mostly from the top which is the government through the ministry of education and its allied agencies (national level) to the bottom of the school (Carnoy, 1999). As Bray (2007) noted most rules and policies found in schools are as a result of daily happening in the society. Ghana runs a decentralised education system where most decision making power has been given to the local and the school level but examinations for senior and junior high schools and selection of students into various programmes at senior high school which still remains a national agenda. Students at the end of their three years programme at the junior high are allowed to select the programmes which they are interested in and would like to pursue at the senior high at their schools however; the final decision chosen by students is however taken by the Ghana Education Service through a computer selection programme. From the interviews conducted from the field, all participants (students)

confirmed that their selection into their programmes was by the computer selection system based on students' performance without quota admission to any gender. The computer selection system tends to defeat the National Plan of Action. Meanwhile the National Plan of Action that led to the establishment of Girls Education Unit was meant to increase girls' access and participation in education with a special focus on girls in science. Once a candidate is selected for a programme to a school it becomes difficult to change into the student preferred programme, consequently displacing the student. Considering the nature of the computer placement programme and the nature of gender disparity in science education at the senior high school, it becomes clear that policy makers in education are not committed to ensuring rights in girls' participation in science. It is noteworthy that a right in education goes beyond agreements, bonds and the provision of primary education (Tomasevki, 2006). However, few schools are flexible on some of these fast policies and rules, and have managed such policies to suit their local context (school culture). Some government assisted and few public schools in Ghana have built the culture of excellence and aim at giving opportunities to all students to pursue programmes of their choice. As noted by some studies that some schools administration are flexible and not so authoritative to staff and students. Schools with such administrations create friendly and welcoming environments for the development of all (Freire, 2005, p. 16). The findings in this study through interview from one of the government assisted schools revealed that girls who were not chosen initially for science by the schools own arrangement made room for them to participate in science. For instance one girl interviewed from school "W" in this study who missed her first grade "A" school to offer general arts is now the overall best in science because the school gave her the chance to offer science giving her the right to participate in science by virtue of good administrative arrangement.

One characteristics of this school is that the head of the school and the head of the science department are females and that might be the reason for their interest in girls participation in science. The assumption is that when females are given the opportunity to head institutions there is tendency for female generation to be reproduced. This further implies that the female head and the head of science department with their position have influenced the administration system of the school and hence the achievement of that student. This is in line with Lockwood (2006) assertion that successful female role models demonstrate that it is possible to overcome gender barriers and also gives an indication that females role model undermine traditional stereotypes consequently reducing persistent effective of gender stereotypes in most society like

Ghana. However, the two other public schools have female heads and male heads of science departments yet do not have such administrative arrangements for students. This suggests that school culture varies from school to school as administration and leadership style also varies. As Freire (2005) noted some schools administration arrangement attract and sustain students others repel students.

School rules

According to Fengshu (2006) gender regimes makes a difference in all aspect of school life and this is mirrored in areas such as organizational management and disciplinary schemes, and this usually depicts the picture of dominate gender relations in the wider society. Interviews with girls in this study revealed that there are rules in the school that tend to favour the boys against the girls and one of such rules that the science girls lamented so much about and mentioned is affecting their performance is the ***siesta*** rule at the boarding house. This compulsory rule which makes students go to rest after normal classes from lunch is observed by boys and girls but according to the girls who participated in this study, the rule is so relaxed with the boys while for the girls' housemistress demand strict adherence to the rule as offender are punished. Punishment ranging from weeding, fetching of water and suspension in extreme cases from the boarding house. This is in connection with Fengshu (2006) assertion that the engendered nature of school culture is often skewed towards a particular gender. From the interviews, information gathered from the girls indicate that science demands a lot of time and they need more time mostly to finish the days' work after school either at the science laboratory, library or the computer laboratory. These facilities closes an hour after school, just the time they are to be in bed whiles their male counterpart have access to these facilities because they are not made to follow the siesta rule rigidly. The girls mentioned that this affect their performance. As Dimock in Bray and Adamson (2007) mentioned, activities of a school's life are most often shaped by the norms and values of the wider society. A typical example is what is found in the school in this study. Within the Ghanaian society, boys are given preferential treatment in most situations during their socialisation. From a personal experience whiles growing up girls are always kept in-doors to do all house chores whiles boys are at liberty to engage in any activities of their choice in and outside the home. Most of the time they are kept for fear of getting pregnant, this cultural norm might be the basis for this rule in the boarding house, which infringes so much on the rights of the girls as well as affecting their performance.

Another school rule that was found in this study as affecting the performance of girls in science and consequently their participation is the rule on the use of school premises and facilities after school. According to Freire, educators are faced with authoritative administrative rules that limit their abilities to take initiatives and to the extent that their activities are being monitored by the highest authority. Interviews and observation conducted from one the schools confirm that students and teachers are faced with the challenge, in that teachers cannot offer extra help for girls and students too cannot have access to use the school facilities such as classroom, library and computer laboratory, to study after school. This invariably suppresses their interest and affects their performance. In Ghanaian culture females are mostly responsible for house chores and that when they get home they cannot learn rather compel to help house chores (Anamuah-Mensah 2000).

5.3 Teachers' attitude.

Brotman and Moore (2004) on the review on gender and science mentioned that the male dominance in science within the context of the school is fast eroding and becoming a thing of the past but studies on schools culture have mentioned that teacher's attitude in the classroom influences students participation during classroom interactions and shows that females are segregated and discriminated against during instructional time (Davidson and Kanyuka, 1990; Skelton and Francis, 2003). Science teachers have been mentioned in most studies as giving more attention to male students than female students. This according to Haase, (2009) negatively influence girls' participation in science. Findings from this present studies in a similar vein agreed with the assertion but does not solely blame the phenomenon largely and attention given to boys. This because findings from the interviews and observations revealed that, during instructional time efforts are made by teachers to give equal attention to boys and girls during science lessons.

However, there are variations in the level of attention given to boys and girls in the science class from the schools. Freire(2005) mentioned love and humility are key virtues that all professional teachers are to possess and exhibit , this will make them love what they are doing and will reflect in the way they interact with all their student by given them all equal attention. Humility will make them accept the difference in the class. Finding from one government assisted school and one public school shows that girls receive more attention as their teacher encourage them some time more than the boys. On the contrary, through the interview with girls, one of the government assisted (mission) and public school; girls are not

participating in science because of the negative attitude of some teachers in the science towards them. Teacher's use of harsh words at the slightest mistake from girls, make these girls feel uncomfortable and as in the words of Freire (2005) "in secured" in the classroom. This affects their performance, further deterring them from pursuing science. A clear example was revealed through the interview as one girl from a government assisted (mission) school mentioned that a teacher told her she should be in home economics class and not science. This attitude of the teacher towards the girl goes to confirm the claim that school culture with the classroom as school's micro culture is the place where societal values and norms are reproduced (Fengshu, 2006; Freire, 2005).

In the Ghanaian society most ethnic groups still hold the view that the woman's place is still at the kitchen, this cultural value is what is displayed in the science classroom. Woolnough (1990) argued that there is the need for schools to recruit graduate professional teacher who are enthusiastic about their job, As Addae Mensah (2000) mentioned that Ghana needs qualified teachers for effective delivery of science education, I therefore agree with Woolnough that there is a need to recruit graduate professional teacher for effective delivery of science. However, I argue that, it is noteworthy that ninety percent of teachers at the senior high schools in Ghana are graduate professional and some with science background. At the visited school some of the professional teachers are pursuing master degree programme yet this resilient hegemonic cultural value is displayed in the science class. This implies that culture is such a strong force which has influence on the life of an individual. Therefore making the problem of teachers' discriminatory attitude towards girls an issue that goes beyond literature. Since this discriminatory attitude are embedded in societal values transmitted through socialisation from infancy, there is a need for change which can be possible through education that all human have equal rights and there is no specific role assigned to females that will influence them on what programme they should pursue. As Donnelly (2003) asserted all human beings should be treated with respect and concern and that educational opportunity should be made available for all irrespective of gender.

In another dimension, studies have shown that school type plays a significant role in girls' participation in class. Brock- Utne (1990) mentioned school type influence girls participation in Tanzanian. Woolnough (1994) however refute this view and stated that girls participation in science has no relation to the school type., Though Brock- Utne study was not specifically based on science but I therefore support the assertion by Brock- Utne (1990), that school type

being it public or government assisted school (mission school) have influence on participation in education and in science in this study. The reason is that through the interviews and the observation from this study teachers' attitude whether negative or positive towards girls in science largely depends on the school type and the type of leadership. As mentioned by Freire (2005) that schools administrators' leadership style plays greater role influencing teachers attitude and behavior towards students. In the present studies low participating in science to greater extent depends on the school type and the leadership style. As noted in one of the government assisted (mission) school teachers are through administration arrangement are accountable to students and their work is monitored by the students and report sent back to the school administration. Such arrangements at this school create an atmosphere of trust and respect between students and teachers and also serve as a check on their behaviour towards all students in the classroom. This increases the confidence level of girls and boys in the classroom as they are all given equal attention increasing their participation in the science class.

A similar observation was also made between the two public schools in this study that one of the schools environment motivates the students at the science department because of administrative structures, the other weak administrative structures influences teachers' attitude negatively towards girls participation in science. As revealed by one of the participant in this study that as long as one is enrolled in the school, their teachers do their best to see all of them perform well and this attitude of the teachers serve as a strong motivation for girls participation in science. This is linked to qualities that every progressive teacher must possess to increase students participation in science. As teachers exhibit love, tolerance and welcome students in the classroom, the students feel secured and hence motivated as a teacher with his or her professionalism guide and motivate them to learn and perform well in their studies (Freire, 2005). From my personal observation as a teacher in Ghana and from greater Accra region these schools with effective administrative systems have a culture of attracting and producing a lot of female science students.

On the contrary, in another government assisted(mission) school in the same region due to lapses in the school administration system the teachers do not treat students equally in the

classroom sometimes use negative and harsh words against some of the girls in the science class.

Although this present study was carried out at the same region, the locations are different and so this might influence the different attitude of the teachers. Also teachers at these schools are from different regions with different cultural beliefs and this might influence their attitude s towards the girls. This is because the region for this study is cosmopolitan area where most people have moved from their original ethnic homes and so some might have been disconnected from some of these cultural values that militate against women and girls hence their positive attitude toward the girls whiles others are not. This might have led to the reproduction of some of these cultural values in some of the schools subtly reducing the girls' interest in science and consequently denying them access into equal participation in science as their male counterparts at the senior high school in Ghana. Comments like ‘’what are you doing in this class you are to be in home economics class is clearly defining gender role and indicate that female role is cooking and science is for men and boys (Kessler et al., 1985).

5.4 Teachers teaching style

Another classroom micro culture found by studies to have great impact on girls' participation in class and in science is teachers teaching style. Evidence from Woolnough (1994) shows that quality teaching of school science play a significant role in the attitude formation of students towards school science. Teaching style proven by studies as effective and distinctive feature for teaching science and capable of increasing girls participation in science is hand-on experience (practical work) Again, hand-on engineering activities are mentioned as increasing girls chance of considering engineering as career and hence their interest in physical science at high school(Angell, 2004; O'connor, 2002) Meyers and Fouts(1992) opined that a teacher's professionalism is seen in the use of variety of teaching strategies and many unusual activities to help bring the best in all students in a given classroom during teaching and learning processes. Freire (2005) in a similar view mentioned the need for professional teacher to be able to blend theory with practice to help all students in the classroom. Findings from this study proved otherwise as some of the teachers could not relate content with varied teaching strategies through classroom observation conducted. This is in connection with Tobias (1990) assertion that some science teachers though knowledgeable about their subject matter fail in

most cases to achieve their primary objectives. As they are unable to use variety of learning strategies to effectively communicate the subject matter. Girls low participation in science can be largely blame on the teaching styles implored by some of the science teachers during instructional hours. Most of these lesson for instance physic and mathematics were taught abstractly purely using chalk and the board with few text books and some without teaching learning material. On the other hand, where some teaching learning materials were used they were not legible and gender responsive.

It is also interesting to note that in the wake of technological society science is taught in some of the schools without computers and projectors. This was found in all the visited schools with some few exceptions. Although this is bound to affect boys and girls, the girls are mostly affected, as the use of such technology would enhance the teaching learning processes. It was revealed that students are not allowed to use the computer laboratory until they are in the final year. Meanwhile such schools have computer laboratory and teacher. However from the interview at the same school one biological teacher was mentioned as helping boys and girls to form internet study groups with other schools from other districts and regions so they could share their experience s through the internet: a strategy the participant mentioned as very helpful. Again from one of the government assisted schools one female biology teacher for her love and resourcefulness was mentioned as using her personal laptop to do demonstrational lessons in class and also mentioned as one who uses projector in her lessons and also you which to the girls is very helpful and encourage classroom participation This is an example of an enthusiastic professional teacher who not only have a good spread of the subject matter but also exhibit subject loyalty by going extra mile using her own resources to help meet the learning needs of the students(Woolnough, 1990).

At the same government assisted school through interviews and observations some of the teachers make use of collaborative learning and so girls at this school are encouraged and motivated in the science class. The girls from this school mentioned that in terms of participation they are equal with the boys and comprehensions of lessons are same as the boys because of the use of effective teaching style by some of the teachers.. Meanwhile in another government assisted school in the same category as the one described earlier, most of the teachers are reported to always use mostly chalk and board and even when using collaborative method in the teaching their grouping is mostly gender bias with boys in one group and girls

in another group. In situations where they decide to use gender –inclusive grouping it is based on ability. Such teaching practices to some extent are subtly denying some students their right to participate at par and share in knowledge with their male counterpart. Such approach to teaching is a reflection of what is happening in traditional setting, women are segregated from men during sharing of idea and all are not treated with respect and concern (Donnelly, 2003).

Variations noted in the teachers teaching method as noted in this study may be due to many reasons as one teacher at the second public school in this study mentioned that lack of teaching learning materials is one of the main problem they face in their school making the teaching of science a real challenge for teachers. Woolnough (1990) opined that schools need to recruit graduate professional science teachers who have good knowledge in all aspect of science as well as areas of specialisation. Contrary to this view, findings from this study through the interview with some of the teachers revealed that some teachers though graduates do not have science background. This could account for lack of innovative and abstract teaching and presentation of science lessons. As teacher in Ghana my personal observation is that teachers without science background who wish to change locations to certain schools schools accept vacant positions for science .In the light of this, this could account for the recruitment of teacher without science background and consequently the unprofessional handling of the subjects. An interview with the district coordinator of STME clinic revealed however that there are periodic workshops and in- service training section for all science teachers, she however acknowledge that sometimes attendance at such workshops are not encouraging.

5.5 School facilities

Many studies on development of education in Africa have mentioned that most schools in Africa either lack or have in adequate facilities to facilitate effective teaching and learning. (Addae-Mensah, 2000; Babaci-Wilhite and Geo-JaJa, 2011; Geo-JaJa, 2013; Samoff, 2007; Spreen and Vally, 2000). The present study found from the interview and observations that these assertions are true. All the school visited in this study lack most of the basic facilities such as well stuffed science laboratories, sufficient computers as least one per students, specimen and relevant text books without many variations among the schools (government assisted and public). In situations where some of these specimens can be found, they are

outdated and some irrelevant to the present trends in the field of science. For instance at one the government assisted school one could hardly identify the specimen displayed and at the other government assisted school for lack of space the specimen are packed in a dusty cupboard with poor ventilation. At the two public schools, they have nice but almost empty science laboratory. Also they do not have adequate furniture and so sometimes students sit in twos or carry chair from their classrooms to and fro the science laboratory. .Addae-Mensah(2000) asserted that urban schools are better resourced in terms of facilities for science but findings from the presented studies proved otherwise as the study was carried out in the nation's capital with one of the schools close to the district education office.

Lack of or inadequate facilities affect the learning processes of boys and girls. However through the interviews from the field, girls are mostly affected as owing to lack of facilities and space at the laboratories one of the government assisted school is reported to be organising physics lesson on Saturdays. This according to one of the participant is very worrying because according to the girl they help their parents on Saturdays to do their house chores and in their various economic activities.. And consequently affect their performance because most of these Saturday lessons which are practical lessons are not repeated and comes at a fee. This implies that the teacher as noted by Woolnough(1994) is not enthusiastic and loyal about the subject he is teaching and has taken advantage of the lack of facilities at the school to extort money from the students: an act which is highly unprofessional as Freire (2005) mentioned love as a virtue every professional teacher must exhibit in the discharge of their duty such teacher lack this professional virtue that will cause the teacher to go the extra mile for the students so all can benefit.. Woolnough(1994) again mentioned that a good teacher is sympathetic and willing to spend time with their student both in and out of lessons going beyond even school work. Therefore organizing classes which are supposed to be held at normal classes but for lack of facilities had to be taken during the weekend should not attract any fee that will deny others their right to participate in the class.

Again, for lack of specimen at the same school sometimes student are made to buy their own chemical and bring in live animal specimen for practical lessons. Such from the interviews with the girls is quite frightening and worrying as some girls mentioned such specimens are difficult to come by and so they are sometime not allowed to take part in such lesson. This can the affect their performance and make them lose interest in science. This school is located along the coast and most people living in these areas are low income earners and so adding

more cost to what they can afford might affect their children and especially the girls as traditionally they help not only in house chore but also in economic activities. As such the caliber of teachers need in these areas are those who will understand the world view of the environment where they work and out of love and enthusiasm will encourage all students especially the girls to participate in science lessons instead of taking advantage of the situation to exploit students leading to denying some the opportunity to participate in lessons.

In the wake of globalization technology has become a major means of teaching and inseparable part of science. It has therefore become necessary that teaching of science be blend with technology. However finding from this study indicate that for lack projector, computers and viable computer laboratories the teacher of modern science in the visited schools are somehow disconnecting the teaching of science from technology .An interview with some of the teachers revealed that they are not using these devices for teaching because they are few and most are outdated and slow in terms of performance. For them using them is a waste of time.

5.6 Relevance of science

Science is recognised as very vital in the organization of our daily lives and it starts from birth to cradle; hence the need for all genders to embrace all aspect of science in its entirety to harness the benefit from scientific knowledge for their well-being. Unfortunately in terms of studying to acquire scientific knowledge most especially at the high school studies on gender and science have argued that girl have greater flare for the biological sciences than physical sciences(Brotman and Moore,2004; Tolley,2003). Evidence from other studies again shows that high school students believe that physical science is more masculine than biological sciences and great passion for the biological science (Wheatley, 1990; Kitetu, 2008).

Finding from this study through the interviews with teacher and students on the relevance of science indicate that both genders acknowledge the benefit of science for the individual and the society. Interviews with all the girls in this revealed that their passion is strong towards the biological science not because is masculine as earlier studies have indicated physical science as male domain but on grounds that the handling of the subject by teachers is what is deterring them. For instance one female participant indicate that she has strong love for chemistry and physics at the junior high school and still do but her performance currently is

worrying as she most of the time struggle to understand what is thought in class. She is however optimistic to work hard to overcome the challenge, but this is from just one who wants to hold on against all odds. This implies that girls' dislike for some aspects of science (physics and chemistry) may not purely be because they perceive it to be masculine but the approaches to the teaching of science is what is hindering their participation.

Again, as Wolnough(1994), noted that department which are noted of not performing very well and have teachers who are not friendly do not attract students, from the interviews conducted in this study most of the girls opt for the biological sciences because the subjects is handled properly and so they identify with the subjects. It is interesting to also note that some girls also just don't like the subjects no matter what the teacher does, how well the subject is handled and whichever school one attend. My personal experience during my high school and college day between government assisted and public school gives me the clear picture that some girls simply do not like the physical science and just prefer the biological science.

Further, girls are attracted to the biological science even though they appreciate and accept all aspect of science because of the way the school is reproducing societal culture of dominance by making them see some aspect of science as male domain and so during the teaching and learning processes lessons are not structured taking into consideration the different types of learners (Cooper and McIntyre, 1996).

Summary

This section presented a thematic discussion and analysis on findings emerging from the field. From the findings five main themes such as relevance of science, teacher factor with subheadings as teachers attitude and teacher style were discussed. Policy and school prohibitive rules were also discussed with sub-headings as policy and school prohibitive rules and lastly school facilities were also discussed. From the discussion and the analysis girls' low participation in science can be attributed to factors within the school with highlights on teachers' attitude and teaching style within the school that reflecting the male dominant culture in the wider society. Also through the analysis and discussion the study identified that the computer selection system also has the potential of displacing students from desired programmes of their choice and most especially science, and those mostly affected are likely to be girls. Also school facilities were identified as one hindrance to participate with those

mostly affected to be girls as this inadequate to lack of facilities leads to poor teaching of science and exploitation by some of the science teachers' to the disadvantage of girls.

Conclusion

This section draws a conclusion on girls' low participation in science with a focus on exploring the influence of school culture on participation in science. It will reflect and highlight on the issues that contribute to girls' low participation in science. A suggestion is also made on what needs to be done to promote, increase and sustain girls' interest in science. The section will conclude with some recommendations.

From the entire study, findings have shown that policy and school prohibitive rules influences girls participation in science. The computer placement system in Ghana is laudable and was instituted to check malpractice associated with admissions into senior high school, but as with every other government policy, this is without limitation. The computer placement system though good like a double edged displaces most of the students and tend to dislocate most students from their choicest programmes. However, a school with an inclusive culture can give opportunities for the students to reselect their programme and in the process have girls participating in science. As other schools have taken the lead by creating the opportunities for the girls to choose and participate in science, others should also emulate and create such opportunity of reselection to make room for more girls to participate in science. Ghana has signed in for the human right laws among them is right to education and move men but study found out that there are rules in the schools that work against girls and affect mostly girls in science as they need more time for their study but are impeded by rules that take away their time. Schools are supposed to be democratic grounds where positive attitudes and values are acquired for the development of the individual and the society at large and not a place for the reinforcement and reproduction of negative societal value that have over the years worked against women and girls. Some of these rules are set with very good intentions to protect girls but its application tends to take their very right from them. Such rules need to be revised and be applicable to all. Through the study there is a clear indication of the relevance of science to all and the need for girls to be actively participating in science at the high school level. Findings from the study shows that although there is awareness of the relevance of science in general, girls are attracted to the biological sciences than the physical science, One factor that

accounts for this preference from the study is the teachers teaching style. From the study it was clearly evident that biology teacher employs various teaching strategies, which the girls are attracted to hence, their preference for the biological science.

Owing to inadequate facilities and well- qualified enthusiastic science teachers and quality of teaching has been found in the study as another element within the culture of a school that greatly influences girls' low participation in science. The findings of this study show that girls prefer biology because the teachers use various teaching and unusual activities to stimulate their interest. In some other cases, teachers' lessons were not tailored to meet the different cognitive style of learning by the students. For instance hand-on teaching or practical work has been found as encouraging girls' participation science (Cooper and McIntyre, 1996), but from the study most of the science lessons are handled theoretically. Physics for instance has been found as not properly handled hence the dislike expressed towards it by the girls was so high. Most of the science lessons are not again related to the socio-cultural context of the students. I strongly agree with Tobias (1990) that the pedagogy of some science teachers though may be qualified is failing to attract most students especially girls due to ineffective communication and the use of various teaching strategies. A point of call here is that teachers are not to be blame solely for their inability to use various teaching strategies because the condition under which they teach as compared to conditions in the western classroom is far different and if anything they deserved to be recommended sometimes rather than blamed. No matter how enthusiastic a teacher may be, their attention is drifted from equity issues in the classroom when facilities for effective teaching are limited. What need to be than rather is to concentrate on motivating teachers from teacher education to focus on creating gender equity when working under challenged conditions in their day to day classroom interactions.

Technology in the form of computers laptops, projector and the use of Internet is missing in the science classrooms in most African schools. Again findings from this study indicated that some of the schools teaches science separately from computer science and so most of the girls are disconnected from this form of technology because it is either the school don't have it, have few and or what they have are not in good condition

Technology has become an essential tool in modern societies. It is used in business, agriculture, health and education. In education, technologies in the form of computers, laptops, projectors have been identified and accepted as an effective means of facilitating teaching and learning all over the world. However, these facilities are found to be lacking in

most African schools. In schools where facilities are available the human resource (teachers) needed to handle them are not available. Most African teachers are far behind technology and so cannot use them in their teaching and learning processes. Teaching with such technology is one of the practical ways to influence girls' participation in science, however these facilities were found to be either out of order, not enough for one on one use or not available at all. Women and girls form more than fifty percent of the total population (GSS, 2010) and are mostly engaged in various economic activities and so their exposure to such technology at the school will be on great importance for them later in life. This challenge again goes beyond the ability of the teacher to provide such facilities needed for teaching, however some have in this study mentioned as using their personal laptops for demonstrational lessons for the love of their work and the students have moved beyond administrative challenges to make their lessons lively through the use of technology.

Again, from the analysis the study found out that girls' low participation in science is influenced largely by teachers' attitudes. The study explicitly shows (with some few exceptions) that science teacher's negative classroom attitudes that make science a male domain persist in the Ghanaian society. It was clearly demonstrated through the study that the hegemonic power relation that exist in the larger society between male female and the traditional norms exercised which is engendered in nature is expressed by most of the teacher (Fengshu,2006; Kessler et al, 1985). For instance it was clearly evident that females are still seen to be linked to domestic role like cooking and so are encourage by teachers to pursue home-related courses like home economics instead of science.

Also from this study´s evidence show that teacher's attitude is not only influenced by their cultural background, but in addition by the school type. It was clear from the findings those teachers who worked under administrations with a culture that has norms and values where no one is above the law; but instead make room for students to be part of the school's administration in terms of discipline which has a way of shaping teachers attitude. Consequently it reflects in their daily interaction with all students in the classroom to encourage an all-inclusive participation in the classroom including science class. This again leads to equal treatment of all students irrespective of gender and so no one feels segregated and discriminated against in class. Further, schools where the administration is able to manage policies from the national level to fit into their local context also create opportunities for girls to participate in science. Furthermore, this study found out that the type of leader

(male or female) influence the leadership schools and their culture. Female heads of school are noted in Ghana for effective and good administration and have been given the opportunity to head most of the senior high schools in Ghana. Finding from this study seem to confirm this belief to some extent that it influences girls participation in all subject including science. This is because they serve as role models for the girls and when they have a strong science background, they tend to promote and assist younger girls into participating in science.

Societal rules, norms, values and practices are believed not to end at schools gate but then enter and influence the day to day running of schools (Bray, 2007).The finding in this study school rules and as noted by (Kessler et al 1985) confirmed the influence by societal value in that rules are to be rigidly applied to girls just as seen experience in the larger society. In raising up children in the Ghanaian society the rule are different for boys and girls in terms of house chores, games and even disciplinary measures. This was evident from the findings as boarding house rules are applied to boys and girls differently. This denies the right to use school facilities at certain times and to some extent affects performance and hence influences girls' participation in science

In sum, based on the synthesis of view from participants, it could be concluded that factors responsible for girls' low participation in science and science education in general are identified as: the policy and school prohibitive rules, the teachers' attitude, the teaching style the school facilities and the relevance of science. These elements found evident in the classroom as the schools micro culture in the Ghanaian context are beyond literature and the study is not blaming teachers solely for the persistence of these elements influencing girls participation in science as the there is always a way out of every situation through education.

Recommendations

Education has been the main key to development in modern societies. It aimed at bringing and promoting positive and permanent change in the lives of the individuals so as to be able to make informed decision and choices for the well-being of their lives and for the socioeconomic development of their immediate environment and the entire society. The study therefore makes the following recommendations that will help change attitudes of not only the

teachers but the entire society to take the participation of girls in science as matter of concern that need urgent attention as they form over fifty percent of the population.

Firstly human right laws must move from policy documents to the masses, there is the need for public education on the human right laws through the print and electronic media such as radio, which is highly affordable, television, and on visible billboards. A clear emphasis should be made on right to education as enshrined in Article 26 of the Universal Declaration of Human Right (1948), which confers on all citizens the right to at least free compulsory education at the basic level. This then implies education is a fundamental human right for everyone irrespective of sex, race, colour and location(Donnelly, 2003). Again the declaration pays attention to inclusiveness particularly to female as they form more over half of the world's population. The need for the inclusion of girls and women in science education without any hindrances must be emphasized as their economic contributions in every society especially Ghana cannot be over looked. Education through these mediums targeting all stakeholders like parents, guidance, chiefs, opinion leaders in society and government involved in the education of the individual will lead to the correction of traditional values and norms that militate against women and girls which individuals acquire through socialization from home. In this way the negative attitude operative in the schools will not be seen because teachers are also members of the society and when a societal decision is taken to favour the cause of women as in the western culture like Norway and Sweden, it is binding on the teacher in the classroom.

On the use of technologies like computer, projector among others one of the main cause of the short life span of those few provided by the government and non- governmental organization is the energizing crisis that has bedeviled the nation. Ghana is blessed with a good weather with a lot of sunshine. I recommend the use of electronic devises at the science laboratory that is compatible with solar energy. All schools including universities should migrate from national hydropower to solar energy, which is always available for effective running of the schools. Science lessons will no longer be determined by power supply and electronic devices used including computers at ICT laboratories will last. Also technology must be a vital tool for teaching science from at least upper primary (primary 4) as at this stage science is an all-inclusive thing, this lead to the formation of right attitude by the girls towards science and this must continue through the pipelines (junior and senior high).

Again on the school facilities I suggest that district assemblies should institute some levy just as they do for other project to help replace facilities at the schools periodically. Further, I suggest versatile, innovative and socially connected heads be chosen to head junior and senior high schools in Ghana as leader with such qualities have a way of lobbying and pulling resource to their schools to help facilitate effective teaching and learning without necessarily depending on government intervention. Such leaders must not be kept at one place but be change from time to time to help other schools at different locations. Such leaders also have a way of motivating their teachers to teach effectively; their presence also serves as role models for the girls. From experience, I recommend here that more women with such qualities mentioned above be given chance to head the schools as most have a way of turning things around and working through difficult circumstance to bring change.

Finally, a lot of mentorship programmes in the music, arts and beauty industry have seen the need to pick girls at the tender age and groom them, I therefore recommend that the summer school clinic in science, mathematics and technology education for girls and boys should also start from upper primary so as to catch them young and inculcate in them the desire to study science and for those who have the desire to study science be encourage from the beginning. I suggest that the fifty percent quota given to boys and girls be revised and girls be given sixty and forty percent for boys until parity to an appreciable level is attained.

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APPENDICES

Appendix 1a: Interview Guide

Interview guide for girls studying science at senior high school.

The study explored school culture and its influence on girl in science classroom as schools micro culture.

1. How relevant is science to you as a girl?
2. Do you agree that science is for boys? Yes/No. b. Give reasons for your option.
3. How did you come to do science in this school?
4. How do you feel studying science in this school?
5. What are your opinions about the rules in the school?
6. What can you say about your science teachers in the classroom?
7. In your opinion do your school facilities support your studies?
8. Are there any factors in this school that prevent girls from participating in science?
9. What do you think can be done to attract more girls into science?

Interview guide for science teacher at the selected schools for the study

1. Do you believe science is for boys?
2. In your opinion do you think science is for boys? Yes/ No. Give reasons for your option(s).
3. How is the selection of student in programmes done in your school?
4. What can you say about your school briefly?
5. How many girls do you have in your science class?
6. Are you satisfied about the number of girls in your science class?
7. Does your school have quota admission for girls?
8. How would you rate the understanding of boys and girls in your class?
9. If your students are to take their final exams, what will be your expectations of the outcome of the exams for boys and girls?
10. In your opinion do boys and girls answer questions equally? Yes/No. Give reasons for your option(s)
11. What are your views on the state of facilities in the school?
12. Does these facilities support teaching and learning?
13. What can you say about rules in the school?
14. How would you rate teaching and learning in this school?
15. What do you think can be done to improve on teaching of science suit the learning needs of all students?

Interview guide for educationist

1. In your view is there a difference in the academic competency of boys and girls in relation to performance in science and mathematics.

2. What is your view on the saying that girls fear science?

3. What school factors are responsible for the low enrolment of girls in science and technology education?

4. What is/are the national policy on the learning of science and technology?

5. Are there any agency/agencies tasked with the responsibility of promoting and monitoring the study of science and technology in Secondary Schools in Ghana

6. What are the national policies on the participation of girls in science in education at various levels of education (Basic level, Secondary, Tertiary)

   6a. Basic level
   6b Secondary
   6c. Tertiary

7. What measures are put in place to increase the participation of girls in science education at all levels of education?

   7a. Basic level
   7b Secondary
   7c. Tertiary

8. To what extent are schools resourced to increase girls' participation in Science

9. Is there a difference in the cutoff point or criteria for selection of girls and girls into Senior High Schools.

10. What is the objective of the STEM concept?

11. What policies have been put in place to train more science teachers especially

12. What milestones have been achieved by STEM concept in relation to girls participation in science?

13. What changes can be made in the teaching and learning processes to establish a better learning climate for the girls in science?

Appendix 1b Observation Protocal

Categories	Descriptive notes	Reflective notes
Teachers competence in teaching science subjects		
Teachers teaching method s and classroom organisation		
Teachers teaching style and attitude towards the students(boys and girls		
Students engagement and involvement in science lessons		
How teachers distributes questions to students		
Teacher use of teaching learning materials		

Appendix 2: Illustration of the Map of Ghana

Appendix 3: Condition of science laboratory

Appendix 4: Enrolment by programme and gender in four high schools

LA BONE SENIOR HIGH SCHOOL

TOTAL ENROLMENT BY PROGRAMME AND GENDER SHS1 – SHS3
2012 / 2013 ACADEMIC YEAR

PROGRAMME	MALE	FEMALE	TOTAL
GENERAL ARTS	268	401	669
SCIENCE	391	190	581
HOME ECONOMICS	6	214	220
VISUAL ARTS	181	45	226
BUSINESS	472	432	904
TOTAL	**1318**	**1282**	**2600**

AMASAMAN SENIOR HIGH SCHOOL

TOTAL ENROLMENT BY PROGRAMME AND GENDER SHS1 – SHS3
2012 / 2013 ACADEMIC YEAR

PROGRAMME	MALE	FEMALE	TOTAL
GENERAL ARTS	283	292	575
SCIENCE	281	152	433
HOME ECONOMICS	5	312	317
VISUAL ARTS	165	86	251
BUSINESS	373	351	724
TOTAL	**1107**	**1193**	**2300**

HOLY TRINITY CATHEDRAL SENIOR HIGH SCHOOL

TOTAL ENROLMENT BY PROGRAMME AND GENDER SHS1 – SHS3
2012 / 2013 ACADEMIC YEAR

PROGRAMME	MALE	FEMALE	TOTAL
GENERAL ARTS	335	315	650
SCIENCE	287	168	455
HOME ECONOMICS	2	302	304
VISUAL ARTS	178	6	184
BUSINESS	389	423	713
TOTAL	**1211**	**1115**	**2306**

WESLEY GRAMMAR SENIOR HIGH SCHOOL

TOTAL ENROLMENT BY PROGRAMME AND GENDER SHS1 – SHS3
2012 / 2013 ACADEMIC YEAR

PROGRAMME	MALE	FEMALE	TOTAL
GENERAL ARTS	312	365	677
SCIENCE	412	201	613
HOME ECONOMICS	4	285	289
VISUAL ARTS	212	27	239
BUSINESS	496	475	971
TOTAL	**1436**	**1353**	**2789**

LA BONE SENIOR HIGH SCHOOL

TOTAL ENROLMENT BY PROGRAMME AND GENDER SHS1 – SHS3
2013 / 2014 ACADEMIC YEAR

PROGRAMME	MALE	FEMALE	TOTAL
GENERAL ARTS	285	366	651
SCIENCE	324	209	533
HOME ECONOMICS	3	216	219
VISUAL ARTS	187	51	238
BUSINESS	412	297	709
TOTAL	**1211**	**1139**	**2350**

AMASAMAN SENIOR HIGH SCHOOL

TOTAL ENROLMENT BY PROGRAMME AND GENDER SHS1 – SHS3
2013 / 2014 ACADEMIC YEAR

PROGRAMME	MALE	FEMALE	TOTAL
GENERAL ARTS	196	215	411
SCIENCE	286	157	443
HOME ECONOMICS	1	276	277
VISUAL ARTS	187	2	189
BUSINESS	346	320	666
TOTAL	**1016**	**970**	**1986**

HOLY TRINITY CATHEDRAL SENIOR HIGH SCHOOL

TOTAL ENROLMENT BY PROGRAMME AND GENDER SHS1 – SHS3
2013 / 2014 ACADEMIC YEAR

PROGRAMME	MALE	FEMALE	TOTAL
GENERAL ARTS	178	284	462
SCIENCE	300	127	427
HOME ECONOMICS	-	345	345
VISUAL ARTS	224	13	237
BUSINESS	289	296	585
TOTAL	**991**	**1065**	**2056**

WESLEY GRAMMAR SENIOR HIGH SCHOOL

TOTAL ENROLMENT BY PROGRAMME AND GENDER SHS1 – SHS3
2013 / 2014 ACADEMIC YEAR

PROGRAMME	MALE	FEMALE	TOTAL
GENERAL ARTS	276	415	691
SCIENCE	365	216	581
HOME ECONOMICS	2	245	247
VISUAL ARTS	205	47	252
BUSINESS	410	315	725
TOTAL	**1258**	**1238**	**2496**

Appendix 5: Letter of Consent from Ghana Education Service

GHANA EDUCATION SERVICE

In case of reply, the number and
date of this letter should be quoted.

HEADQUARTERS
Ministry Branch Post Office
P.O. Box MB-45
Accra

Your Ref: GEGES/HQ/PRU/10/14/0421

3rd October, 2014

Republic of Ghana

TO: THE HEAD OF SCHOOLS/INSTITUTIONS

This is to introduce to you Ms. Joyce Rhoda Akuaku, a Master's degree student from University of Oslo-Norway, who wishes to choose your school for her fieldwork and research programme.

By this letter, the head of schools and institutions selected for the research are being informed that permission has been granted to Ms. Rhoda to conduct her fieldworks as part of the requirement for the award of the master's degree.

The student is also advised that her activities should not interfere with instructional periods of each school but should be conducted in consultation with the class teacher in a way that will not abstract students from their studies.

Your cooperation is highly anticipated.

Thank you

CHARLES AHETO-TSEGAH
AG. DIRECTOR-GENERAL

Cc. Regional Director of Education
Greater Accra Education Directorate
Accra

Ms Joyce Rhoda Akuaku
Accra

Appendix 6: Letter of Consent from Wesley Grammar School

WESLEY GRAMMAR SCHOOL

METHODIST CHURCH GHANA

HEADMISTRESS
VICTORIA ABA AGYAPONG (MRS)
B. A (HONS)

Tel: (+233) 302 - 301040

Our Ref:.....

Your Ref:.....

P. O. Box DS - 2287
Dansoman, Accra

27th April, 2015

Date:.....

TO WHOM IT MAY CONCERN

LETTER OF CONSENT

I write to confirm consent for Ms Joyce Rhoda Akuaku to use pictures taken in the Wesley Grammar Science Laboratory for the purposes of her thesis.

These pictures were taken during interviews conducted by Ms Akuaku in the school for her thesis on the topic: "Girls low participation in Science, a comparative study of four selected Senior High Schools"

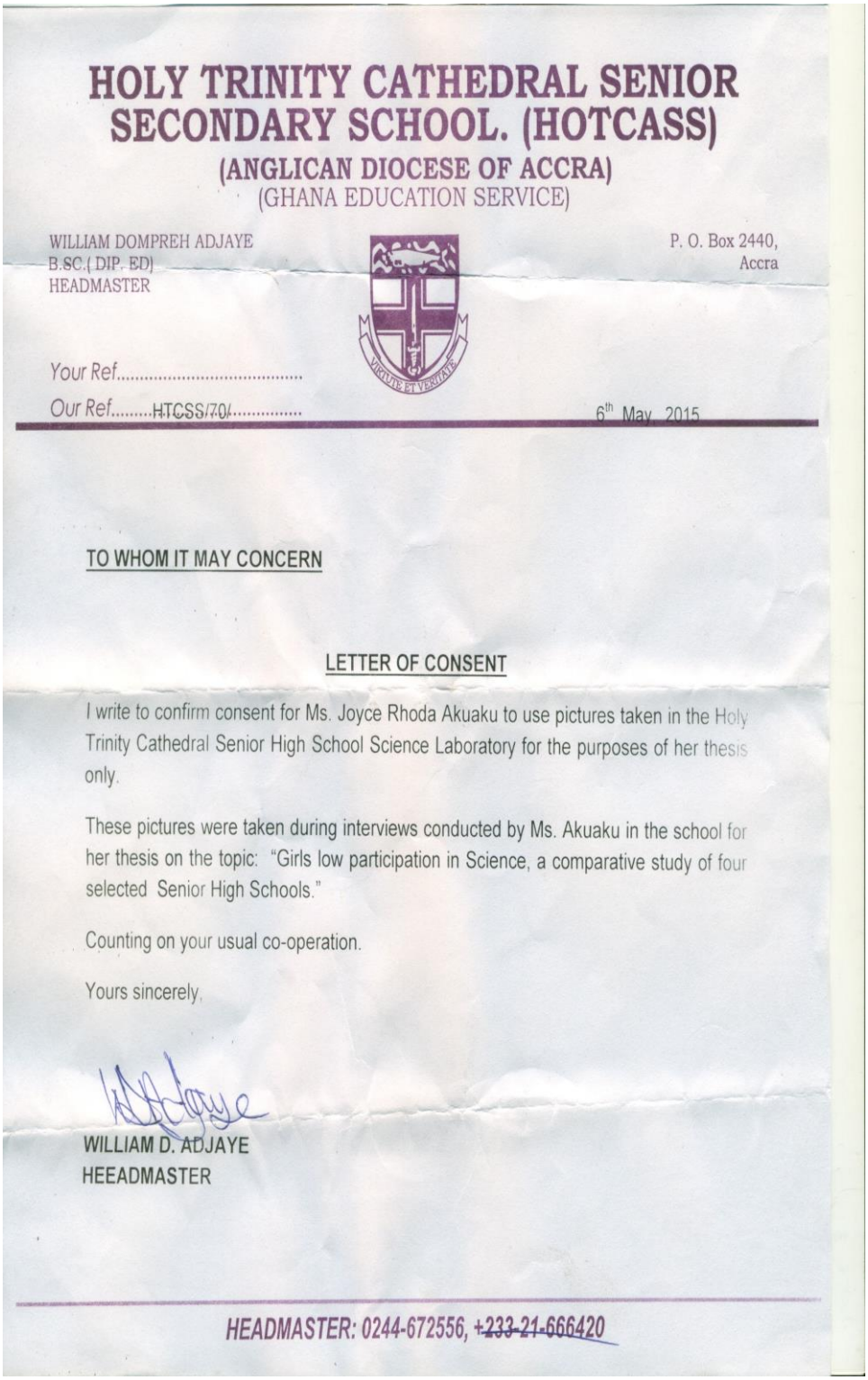
Yours sincerely,

.....

Victoria A. Agyapong (Mrs.)
Headmistress

We are therefore Christ's Ambassadors (2 Cor. 5:20)

Appendix 7: Letter of Consent from Holy Trinity Cathedral high school



HOLY TRINITY CATHEDRAL SENIOR SECONDARY SCHOOL. (HOTCASS)

(ANGLICAN DIOCESE OF ACCRA)

(GHANA EDUCATION SERVICE)

WILLIAM DOMPREH ADJAYE
B.SC.(DIP. ED)
HEADMASTER

P. O. Box 2440,
Accra

Your Ref.....

Our Ref.....HTCSS/70/.....

6th May, 2015

TO WHOM IT MAY CONCERN

LETTER OF CONSENT

I write to confirm consent for Ms. Joyce Rhoda Akuaku to use pictures taken in the Holy Trinity Cathedral Senior High School Science Laboratory for the purposes of her thesis only.

These pictures were taken during interviews conducted by Ms. Akuaku in the school for her thesis on the topic: "Girls low participation in Science, a comparative study of four selected Senior High Schools."

Counting on your usual co-operation.

Yours sincerely,

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