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**GENDER DYNAMICS IN MATHEMATICS LEARNING AND TEACHING IN SELECTED
BOTSWANA PRIMARY SCHOOLS**

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ABSTRACT

This thesis combined gender and classroom interactions in an analysis of patterns of gender inequalities during mathematics learning. These patterns will be analyzed with the purpose of establishing the extent to which gender dynamics impacts on teaching and learning of mathematics. Gender dynamics in mathematics learning looked at what actually happened in the classrooms with focus to Botswana's 6th grade primary students. Pre-recorded digital versatile discs (DVD's) were used which portrayed mathematics teaching and learning activities in each of the eight selected schools from the two districts which were Kgatleng and South East. The data which was in the form of (DVD's) was obtained from Human Science Research Council (HSRC) - Stanford University - University of Botswana Regional Education Study.

An instrument in the form of checklist was used and this also required a gender audit. A triangulation method which included the integration of both qualitative and quantitative approach was adopted in the methodology for easy presentation of findings. The Gender Inequality Theory of Wollstonecraft was used as a theoretical framework. The combination of gender and classroom interaction threw new light on the driving forces behind gender inequalities and on education and on the role of education in this context.

CHAPTER 1: GENERAL INTRODUCTION

1.1 INTRODUCTION

1.2 Contextual situation

By the second decade of the twentieth century a few feminists were dreaming of a world in which traditional gender distinctions would wither away as a result of truly identical coeducation. Coeducation that conforms to reality and is not illusionary could gather up a platform in which both men and women have equal access to opportunities presented to benefit them politically socially and economically. The issue of the mathematics subject matter knowledge of primary teachers has recently become a topical issue not only in the United Kingdom, but also beyond. Teachers play crucial role in education and it is not surprising that their knowledge of mathematics subject matter is considered to be a major concern. This is because when a teacher is knowledgeable in the subject matter, they invest more in the affective quality of the class (Rowland, Martin Barber and Heal, 2001). There will be need to evaluate our educational practices, in order to determine how they affect female and male students during mathematics learning respectively.

According to Chipeta, Mazile and Shumba (2000), the quality of education is one of those critical areas which will continue to be debated in the 21st century. Some of the prevailing concerns in education are related to gender inequalities, imbalances, inequalities in access and quality. The Botswana Revised Policy on Education (1994) has identified gender equality in education as an important component in the education of Botswana children (p.31). Gender inequality issues in education have been addressed in many educational forums. It is, however, evident that in most cases scholars in this area tend to focus on how females are disadvantaged. Other scholars support the above statement. They argued that gender inequalities in the school environment, in the curriculum and in instructional materials have been found to be a significant variable in the students' school performance.

Such inequalities have negative effects on both females and males. However, the effects are more detrimental to the lives of females. This process contributes to future sex segmentation and differentiation of skills in the labor force. For example, women find themselves with less occupational preparation. They find it difficult or impossible to compete for high paying jobs such as in areas of medicine, engineering and other area dominated by men. Women become concentrated in low paying jobs such as in areas of medicine, engineering and other areas dominated by men. Women become concentrated in low paying jobs such as typist, teachers, nurses and other occupations stereotyped as feminine. It is also indicated that overall sexism in schools can result in psychological, social, physical, economic and educational harm (Bosow, 1986; Klein, 1985; Sadker and Sadker, 1982).

Campbell (1995) posits that teachers perpetuate the inequalities between male and females that are visible today. Teachers therefore have the authority to ensure that these practices are put to an end.

Making the school a social center is the most significant thing, this should be put into practice, not just in theory (Benson, Harkavy and Puckett, 2007). One of the most significant criticisms leveled at education as a democratic and liberating influence is that; in theory, most theorists and policy makers believe education should be a liberating and democratic influence (Skolnick, Langbort and Day, 1982). But looking at what actually happens in the classroom, teachers often stereotype mathematics to be a male domain. This reflects in the teachers' propensity to overestimate the capability and expectations about male students in mathematics. In addition teachers usually expect more and have positive attitude about male students than their female counterparts.

According to Murphy & Gipps (1996), they emphasized that one way to begin to deal with tackling the problem of gendered mathematics is not to direct one's attention toward the subject only, but to scrutinize carefully, in detail as to how people remember, recollect and become informed within the subject. Many, who work in the field of gender and mathematics, have suggested that we have to identify a pedagogy which is unique to females before we can ensure equity in mathematics. We should direct our attention to how viewing mathematics from a male perspective or point of view have been seen to be destructive to females lives. At the moment the main problem is actually how mathematics is taught and presently viewed. I am convinced that actually females have come to accept that the way mathematics is currently taught and learned limits the lives of females rather than adorning them (p.78-79).

The formal interrogation of what females actually have to say in the recently discovered research, which is markedly different from what was done before will help me as an individual and especially others to comprehend the meaning of teaching, learning, gender and mathematics better. This was my personal experience when doing a field work for my research and this built a strong argument on inequalities in mathematics learning.

I usually see Mrs Masego Reteng (pseudonym), who teaches in the primary school in the same area that I am staying. I had previously on many occasions visited the primary school she teaches in. We would extensively be involved in discussions on gender issues and education, the teaching profession and the everyday challenges she faces. On the first occasion when the discussion started she would try to reserve her comments and speak a little bit. I visited her on several occasions and each day seemed to change since now she could come up with something to discuss and she would lead the discussion as I listen to her brilliant, organized ideas and she would look shyly at me and say, "I talk too much these days isn't it"? I smiled and said to her there is a lot that someone can learn from you; you talk a lot of sense. She burst out laughing, and said "I appreciate that you can learn a lot from a primary school teacher". I told her primary school teachers are the most knowledgeable people since they deal with children from a tender age and understand children and everything that goes around in

the education system more than everybody else. She smiled and said, "People miss out that point, it's really a pleasure to know that there are people out there who honor us". From all these I have had a partnership relationship before having an oral interview with Masego.

With Mrs Gomolemo Aageng also her (pseudonym), I established a relationship with her ever since we started our graduate programs, we shared core courses. Because of this we had a lot in common to discuss. We also had a lot of different experiences in terms of the level of students that we teach and the challenges we face. I was very interested in burning issues at primary level and she was interested in knowing burning issues at secondary level. We used to discuss this issues which were similar and different and we would have different opinions. In the second semester I could now feel now we had a partnership relationship and that is when we had our interview.

An oral interview with Mrs Masego Reteng, went on as follows as I asked her to tell me her lifetime story as a female mathematics teacher, her experiences and anything she feel she wants to say and she started as follows:

"When I was a student I hated Mathematics, I was taught maths by female teachers from primary school level to junior secondary school level. When I got to senior secondary I was taught by a (male) teacher who encouraged me in maths, and always beat me up when I did not do well. I believe we teachers have an influence on gender differences in mathematics performance of students, because as teachers we tend to encourage students at what we are good at. When we look at males they are good in mathematics and females are not. I believe my mathematics teacher encouraged and beat me for not doing well in mathematics because that is where his passion was; actually that was his subject. What I liked about him he encouraged boys and girls equally. I continued with Mathematics, not being passionate with it but just as a subject. As a teacher, I realized that at primary level boys are good in numbers and girls in reading. I tend to encourage boys to do mathematics because they are good, and I encourage the girls to concentrate more on languages because during the earlier stages of learning girls are good in languages than mathematics. Even at preschool level boys prefer drawing and girls prefer coloring, so you can notice this differences at any early stage that boys like doing challenging things. When I give a mathematics class exercise, when the boys finish I am quick to ask them to offer assistance to the girls. I think I don't allow them to struggle because girls don't want to think".

An oral interview with Mrs Gomolemo Aageng went on as follows as I asked her to tell me her lifetime story as a female mathematics teacher, her experiences and anything she feel she wants to say and she started as follows:

"I liked Mathematics just from childhood. I was taught by female teachers, but they failed to bring out the value of Mathematics and so I didn't understand the value of Mathematics. I did not believe Mathematics was a subject for males; this was evident as I outperformed my brother who was repeating the standard I was in. The teacher always shouted at my brother telling him, how he could let a girl outperform her, and for that

matter a younger sister. I started losing interest in mathematics at tertiary level. I think it was because of the way it was taught. It suddenly became a difficult subject which was enjoyed more by males; hence I decided not to continue with mathematics. As a primary teacher we just teach every subject, hence I also teach mathematics. As a Mathematics teacher I have found that, boys participate more in mathematics and girls look down upon themselves during mathematics learning. Girls believe that Mathematics is tough and they prefer languages. Usually I divide the class into groups of mixed gender and mixed ability and allow the girls to try doing Mathematics problem without assistance of the boys. The boys always want to pull the girls down and to show them that mathematics is their subject”.

Feminist scholars argue in a persuasive manner that most of the practices that have been part of our lives have been elucidated from the male point of view. From this, feminist believe that since females have been excluded in generating knowledge, especially in research. The explanation of the world through the male way of thinking has been seen to provide information that is not complete and fully fleshed which results in providing information that is not true. This becomes challenging as the question of who generates knowledge and from whose perspective knowledge is generated comes up and hence the knowledge generated may be wrong. In the past centuries if women’s ways of thinking have been taken into consideration then the way women view life would have been better and most much desirable and comprehensive (Murphy and Gipps 1996). This research is proving fruitful in part, because of the researchers’ conceptual work on how feminist ways of thinking may be endowed with desirable characteristics of making decisions especially to our knowledge of mathematics education work. This is moving the field beyond gender and academic performance to what actually happens in the classroom. This includes subtle and hidden messages transmitted to students as they interact with teachers and the behavior and attitudes of teachers to male and female students and the different ways in which students interact with each other during mathematics.

It is indeed true that we should be able to accept that we have been so acculturated by a society that has been dominated by males. Hence the neutrality of the subject such as mathematics is inaccurate and therefore not complete. This might be because the wrong questions have been asked when studying gender and mathematics. This may suggest if there could be better sets of questions studied from the feminist perspective, which would actually help in gender and mathematics learning. Focus will be on how gender dynamics mathematics impacts on mathematics learning and when it occurs, with what outcomes, and whether this result in male and female students showing gaps in knowledge. All the above will be looked at comparing male and female students and looking at to whose advantage are the above done?

1.3 Background to the study

1.3.1 Historical background

According to Mannathoko (1995), the historical nature of the gender inequalities within Botswana’s education can be traced to the traditional domination of men and sexual

politics of pre- colonial Botswana states. Even though there was a distinct division of labor in the pre- colonial communities, men and women's work did not rigidly adhere to western notions of the division between the home and outside the home. It was the advent of Christianity, followed by the British colonialism which brought significant changes to traditional male dominated institutions. Western education coupled with Christianity introduced and institutionalized the separation of the home and the outside home. Labor migration and Western education discouraged women's confinement to their homes. Furthermore economic and social changes have compelled them to take up multiple roles in the home and outside the home. Although Western education began to open opportunities for females outside the homes, it was men who gained access to higher education and dominated important decision making position outside the home. With independent mass, education provided males and females with equal opportunities to both primary and secondary schooling level. Despite the same enrolment level for both boys and girls, it has been observed that females were seen to be less successful at senior secondary and tertiary level (p.2).

1.3.2 Contextual situation

1.3.2.1 **Access**

In virtually all countries, educational opportunities for girls have traditionally been more limited than those for boys. Correction of this imbalance has been one of UNESCO's major concerns since the organization was founded in 1945. Of particular concern to educators in many countries, both industrial and developing was the widespread tendency for girls to participate less in technical and science-related studies. Beliefs about the differential abilities and appropriate roles for the sexes have led to differential access to particular aspects of the curriculum. However, changes have occurred which have been associated with strategies to enhance girls' access to, and engagement in subjects where their representation and performance in relation to boys was poor, for example in science and mathematics. Change has been effected in many countries (England, Australia, Scandinavia, Finland) leading to increased participation and improved performance for girls (Murphy and Gipps, 1996).

1.3.2.2 **Retention**

In the context of Botswana, National Commission on Education (1993), the report stated that;

“Looking at the situation with respect to performance in science and mathematics at different levels of the education system is most disconcerting”.

This was the original rationale for the introduction of the Pre Entry Science Course (PESC) in 1977. PESC basically entailed an intense training program of five to seven months. This was basically for a selected group of students who were willing to continue studying science or science related careers. These students were selected after their O-level examination, which is for secondary school leavers. The students started serving their one year national service before their fellow mates who were not intending to continue with science or science based careers. These students were then admitted at the University of Botswana. The program mainly focused on covering basic skills in

science and mathematics. Other methods were also employed, which included field trips and more exposure to practical work, which entailed hands on experience (National Commission on Education, 1993).

On realizing the significance played by the technological and scientific advancement on the country's economy, this was an eye opener to the government of Botswana. It then decided to plan ways of encouraging as well as making Botswana students to be interested in mathematics, science and technology by putting into action the plan of a new bursary system. This was different from the past experience, which tended to award scholarships to all students irrespective of the courses they chose. On completion of their tertiary schooling these students were expected to pay 5% of their starting salary to the ministry of education. This practice changed in 1995, when scholarships was now based on critical human resources required by different sectors of the economy in the country. Those students who chose to follow careers which were urgently needed, such as the science and technology profession, and were also viewed as contributing a larger portion to the development of the country. These were given 100% grant to their education while others had to contribute a certain percentage to their education. The fields which were given priority were mostly those ones which were science based, and these included metallurgy, basic science, geology, mathematics and science. (Garegae, 2006).

To meet the requirements of these science based disciplines having a good pass was required as a prior condition as stated by the university calendar (University of Botswana, 2006). As a result, whether one will qualify for government scholarships for the science based disciplines will be measured by good performance in mathematics and females tend to lose out in this equation.

1.3.2.3 *Performance/ achievement*

In this new context, whether an individual will have an opportunity to participate in the government scholarship scheme was determined by their performance in mathematics which had to be good. Hence girls did not have equal opportunities like their male counterparts at the end of their schooling because of their poor performance in mathematics. This also meant that they did not benefit from the scholarships set aside for science- related programs which actually led to high paying jobs (Government of Botswana, 1995).

1.3.2.4 *Career opportunities*

In the last five years, the government of Botswana has introduced a scarce skills allowance which raised the salaries of professionals in chemistry, physics, mathematics, and computer studies by 25% above those of others, as an incentive to attract more students into these areas (*BOPA Daily News*, 22 August 2011). In this scenario males are in the majority of those who earn this higher remuneration. In the same way, boys who continue learning mathematics to higher levels of education will have better labor market opportunities later in life than females.

1.4 The Purpose of the study

The purpose of this study is to establish the extent to which gender dynamics in mathematics learning impacted on teaching and students' learning in selected Botswana primary schools. This study seeks to investigate and analyze patterns of gender inequalities during mathematics lessons.

1.5 Scope of the study

This study used triangulation method which will include the integration of both qualitative and quantitative approaches for comparison reasons was adopted in the methodology for easy presentation of findings. An instrument in the form of checklist was used and this required a gender audit. Pre-recorded digital versatile discs (DVD's) which portrayed mathematics teaching and learning activities in each selected school. The verisimilitude of the footage or how true to life is the recordings maybe an issue. It should be noted that with the use of digital versatile discs (DVD's), having a typical lesson was difficult because of the possibility that the teachers and students staged for the camera. Some of the important behaviors that constituted gender dynamics may have been missed out because teachers and students knew they were being recorded. It was necessary to do several recordings to get the genuine behavior from teachers and students. Additionally the eight schools selected were from the two districts of Kgatleng and the South East. While raising important gender and education issues, the findings may not strictly be generalized to the whole country.

The standard six levels were chosen because of its important characteristics. First of all, the middle school years (defined here as grade 4 through grades 8) determine whether students will participate in the academic track, a pre-requisite for access to high levels of mathematics and science courses (which in turn, predict higher performance levels in these subjects). Second, these years have been pin pointed as the period during which female minority interest and achievement in mathematics and science decline. Thirdly the middle years (the pre-adolescent period) are a time of great developmental change in the psychomotor, effective, social, and the cognitive domain, dictating special educational needs (Claire 2004). This study also involved schools which were attended by both males and females at the same time. There are no schools in Botswana that are attended only by girls or boys alone (single sex school). Hence having a set-up of a school that is attended by boys and girls alone would give some information of great significance for use on comparative education and also for Botswana as a case study, which would be used for comparison with other studies done in other countries.

CHAPTER 2: A DEFINITION OF THE INVESTIGATION (OR ISSUE)

2.1 STATEMENT OF THE ISSUE

Although there have been many studies on the differential performance of girls and boys in mathematics, very little research has focused on how the day to day learning environment differs for them. Within the context of Botswana there is emerging evidence that females are systematically discouraged from entering the mathematics and science fields. The discriminatory practices in Botswana's education structures are perpetuated by cultural beliefs, values and norms embedded in all the socializing agencies, including the schools. It is not only in Botswana where this happens. Countries in South East Asia have had similar experiences; boys and girls are channeled to particular subject areas, with males being placed in mathematics and science (Baden and Green, 1994).

The patriarchal culture has identified different roles for women and men in the society. This differential treatment with its expectations and attitudes may contribute to gender dynamics in mathematics learning. There is also evidence that girls who study mathematics and science at the primary and secondary levels face different types of obstacles. Classroom interaction and daily learning experiences are among some of the environmental factors that continue to discourage girls from taking a keen interest in mathematics (Chipeta, Mazile and Shumba, 2000).

According to the Report of the National Commission on Education (1993) regarding the attitudes of students towards mathematics and science, the study revealed that students had a positive attitude to both subjects, with science being viewed more positively. In the case of mathematics factors that influence attitudes are the teacher factor, students own concept and the usefulness of the subject.

2.2 RESEARCH QUESTIONS

1. What are the gender dynamics in mathematics teaching/learning?
2. To what extent do teachers interact differently with male and female students in mathematics teaching/learning?
3. To what extent are interactions of male and female students in mathematics teaching/ learning gender biased?
4. To what extent are some of the approaches used for teaching favor boys or girls?
5. To what extent is the seating arrangement segregated according to gender in mathematics teaching/learning?
6. What is the significance of the seating arrangement that is segregated according to gender in the African context?

2.3 A DESCRIPTION OF THE ISSUE

Gender and mathematics remains a crucial field in education, which can be termed as a prerequisite to educators and researchers in education. It is both inquisitive and disturbing that gender and mathematics is considered by few researchers as an academic field in the twenty first century. This is contrary to the foundation laid down by

the people who started from scratch in this academic field. The following may be attributed to contributing to the lack of attention that this discipline gets, the increased number of girls who perform better or similar to boys in mathematics (Holton personal communication, 1989).

I will argue that girls and women are strategically, through structure and agency, prevented from entering into fields which deals with mathematics and science. This thesis will provide vitally important understanding the origins or root cause of the inequalities.

2.4 IMPORTANCE OF THE STUDY

This study seeks to investigate and analyze patterns of gender inequalities during mathematics lessons.

This research is proving fruitful in part, because it could be argued that what is said to constitute knowledge in gender and mathematics has been deduced from scholarships that utilized the positivist perspective. This perspective holds that the only way to establish the truth and objective reality is by using the scientific method. While research, conducted from a positivist perspective has provided very rich and powerful information. Most importantly it has, laid down the foundation in gender and mathematics. It is also my belief that, research carried out from the feminist perspective will expose inequalities by privileging women's experiences. Their interpretation of how they are marginalized by the dominant male practice is at the core of feminist research. In addition, it will privilege the women's voices. While the positivist perspective emphasizes the irrelevance of the female and male differences: contrary to feminists' perspective which emphasizes that, it is this difference between males and females that is crucial to the learning of mathematics. Feminist perspectives provide access to alternative discourses to help understand how identities are shaped and meanings constructed. This study will look beyond gender inequalities during mathematics learning, and further into the significance of the seating arrangement that is segregated in the African context (Fennema, 1990).

2.5 DEFINITION OF TERMS

The gender dynamics in mathematics learning- in this study was conceptualized as the difference in the way teachers interact with male and female students to the benefit and development of students. The implication being that both male and female students are made to benefit equally.

Mathematics learning- in this context refers to all students (males and females) in the class being there to obtain knowledge together and from each other. Here students confirm their answers and general statements they have made about concepts being discussed. This is done so, that the work they present is accepted both by the teacher and the student. In doing so, they often discover their own misunderstanding and correct them. Students need to be clear how they arrived at their conclusions, but with the teacher still retaining ultimate responsibility and authority.

Positivism- is a perspective that holds that the only way to establish the truth and objective reality is by the use of the scientific method.

Feminism – The exposure of gender inequalities and gender- oppressive behavior

2.6 THEORETICAL FRAMEWORK

2.6.1 Gender inequality theory

This study is informed by the Gender inequality Theory of Wollstonecraft .The gender inequality theory of Wollstonecraft in Falco (1996) states that, men and women are not only situated differently in the society, but are also unequally treated Wollstonecraft provided the first major theoretical exploration of gender inequality. Wollstonecraft's work is concerned with the emancipation of women both from the domination of men and from their subservient beliefs and conduct. Wollstonecraft views things from the liberal feminist perspective, who continues the tradition of seeking equal rights to education and employment.

Despite her strong views on gender equality, she insists that she did not seek to influence women to revolt against men or government authority. Montgomery and Collette (2002) states that

“Like many liberals she did not envisage a fundamental revision of structures and institutions. She wanted to change attitudes, so that while society has the same forms, it was animated by a different spirit. She wanted to establish through ‘reasoned’ argument that women were not inferior to men and that it would be to the joint interest of both to think so” (p.73).

In the process of making her argument on behalf of equal education for women, however, Wollstonecraft also laid out theories which explained the status of women on the basis of how they interact with each other socially, with a recognized remedy of the law and with the surrounding in which they live. She maintains and holds high her belief that women should be able to sustain themselves using education as their tool to survive. This should be able to sustain them, whether they are married or not, and they should be able to strive for the same professions that are seen to represent the public sphere such as business, law, medicine and to even be represented in parliament (Nayar, 2010).

In Montgomery & Collette (2002), Wollstonecraft rejects the established view that women are naturally weaker or inferior to men. She argues that lack of formal education relegate women to a lowly social status in relation to men. She proposes that women must be treated as equals because they play a crucial role in society and that this should not be seen as overturning existing hierarchies of power.

Although Wollstonecraft borrowed from Locke and Rousseau on education, her proposal on education extends beyond their assertions in that she uses gender as an analytical tool and theorized that education is a public good that should be used to correct social ills. This unequal treatment can also apply to boys and girls in educational

institutions where female students are sometimes denied what male students are granted. This also applies when male students are denied what male students are granted.

CHAPTER 3: REVIEW OF LITERATURE

3.1 LITERATURE REVIEW

The literature review presented previous research related to the study. The previous research was integrated and not merely enumerated. The literature review will map the historical developments of the problem, so as to locate the study in the relevant time frame. The literature review will point out the strengths and what is lacking in the studies that is hoped to be achieved. Studies will be compared and contrasted and conflicting or inconclusive results will be noted. The researcher will include a review of the methodology used, analysis and findings in studies so that the reader draws his/ her conclusions, and the researcher ends with a statement of what is lacking in those studies whilst pointing out researchers own point of view where tentatively agree with what the other authors say. The literature review is organized according to research questions, to allow ideas to flow logically. It starts with literature on education as a public good to benefit all which tends to support the gender equality theory, the theoretical framework which informs this thesis.

3.1.2 Education as a public good to benefit all

During the 1960s, many liberals argued that equalizing educational opportunities would reduce social and economic inequality. In particular, if the formal educational attainment for the poor and the working class in general improved relative to the rest of society, their bargaining position in the market would show a corresponding improvement (Jencks, 1975).

In the 1950s and 60s, western liberal sociologists were preoccupied with the question of inequality of educational opportunity. They reason that the inequalities are morally wrong. This view is in consonance with the thinking of liberal governments who are concerned with getting the best return on investment in education. The wastage of talent created by unequal educational opportunity is seen as reducing efficiency of the educational system in meeting the demands of the economy. In addition to these calls by liberals critical voices took the view that governments had the moral duty to invest in education on behalf of citizens. Reasoning that the centrality of education in shaping peoples' life chances, demands that it should be freely available to all as a public rather than a private good. The public good 'nature' of education, they argue, demands that issues of gender, social class and race, among many, and above all use a holistic approach (Haralambos, 1985).

Gerald (1980), defined 'education' as a service that is absolutely necessary and hence should not be paid for by the public. He asserts that it is vitally important for the state to educate its people. Hence education should be a right and not to be transformed into a commodity. The phrase "primarily by the state" implies educational provision by democratically elected central and local governments, supplemented by free provision from religious or voluntary agencies. The phrase "without direct charge" recognizes that the costs of education are considerable but argues that these should be met through a public taxation system.

The same thinking urges that education should be seen as a basic human need to which there has to be universal access. From a gender perspective this will address issues of equality of opportunity for the girl child. When education is defined as a private good, parents often re-prioritize family resources in favor of the boy child. Thus issues of whether education is a public or private good thus hits at the center of the gender and education discourse. The next section of this study addresses some issues within gender and education debate.

3.1.3 The Gender dynamics in mathematics learning

Montgomery & Collette (2002) whilst using the same basic framework, has a somewhat different emphasis that;

“Modern society is still flawed in its treatment of women; the tendency of men regarding women as their property still exists, and not as persons in their own right who may have other talents to fulfill, in addition to their roles as wives and mothers. Women cannot be exclusively defined by their relational capacities. Men and women have distinct natures; they also have gifts that are similar, including intellectual attributes” (p.73).

They also strongly criticize an education for women designed to domesticate them to meet the needs of men. They conclude their argument by stating that the difference in attainment was solely due to different education, not differential capacity.

This is further supported by Murphy and Gipps (1996) who posit that in the western world, the discourse of achievement and educational practices has traditionally focused on boys as the main concern. They further assert that in Europe girls' good performance in a particular subject serves to lower its status.

Girls' academic competence has been constructed as indicating mediocrity of mind while that of boys' under-performance is labeled healthy idleness. Additionally, when boys are incompetent in a subject the methods of teaching and learning are changed while girls themselves, are to be changed to fit the existing instructional techniques. According to Chipeta, Mazile and Shumba (2000), the quality of education is one of those critical areas that continued to be debated in the 21st century. Some of the prevailing concerns in education are related to gender inequalities, lack of equal opportunity and access.

The Botswana Revised Policy on Education (1994) had also identified gender equality in education as an important component in the education of Botswana children. Gender inequality issues in education have also been addressed at many educational forums. They argue that gender inequalities in the school environment, in the curriculum and in instructional materials have been found to be a significant variable in the students' school performance.

Such inequalities have negative effects on both females and males. However, the effects are more detrimental to the lives of females. This process contributes to future sex segmentation and differentiation of skills in the labor force. For example, women find themselves with less occupational preparation. They find it difficult or impossible to compete for high paying jobs such as in the service areas of and other areas dominated by men.

It is also indicated that overall sexism in schools can result in psychological, social, physical, economic and educational harm (Basow, 1986; Klein, 1985; Sadker and Sadker, 1982). This is further supported by Oakes (1990) who posit that both males and females should equally benefit from learning mathematics. It cannot be disputed mathematics has proved to be important in all aspects of life. This can be social, economic, and on issues concerning leadership in the world of today that is driven by information technological revolution.

The NCTM (1989) concluded that:

“Tolerating the growing inequalities which happened in the historical events of schooling needs to be questioned and has no place in our modern technological society. In our society mathematics is not an equalizer; it has become a sieve, which is used to select the few while rejecting the majority” (p.4).

The increasing numbers of research assert that girls and other minor groups in society have been swindled in schools. This has been evident as girls received minimum encouragement from the teachers and have limited opportunities, when it comes to science and mathematics learning, in comparison to their male counterparts. (AAUW, 1992; Oakes, 1990; NRC, 1989; NSF, 1994). Differences on the basis of gender have decreased; based on past research (AAUW, 1995; Lee, Bryk and Smith, 1993).

Women and other groups that have been disadvantaged and are not well represented. This is due to the fact that when it comes to being well equipped in decision making, a skill in continuing with the following, careers related to science or mathematics, women and other disadvantaged groups tend to be at a rejected. It has been shown by research that differences between males and females in relation to their ability and how they perceive mathematics continued steadfastly. This occurred during their entire school life. Females are frequently reporting to be less confident in their ability. In addition when they grow older, they express a feeling of aversion in mathematics.

According to Garegae (2006) it can be said that mathematics is not only used to control who may pass through to continue with science related careers. Mathematics tends to furnish individuals on calculations involving number or quantities in basically all subjects. Hence unequal access to mathematics for both girls and boys would mean that girls will be unable to access higher education and high paying careers, if boys do better than them in mathematics.

In addition, because of their internalization of cultural messages that discourages them from mathematics and the sciences, females are unlikely to believe that mathematics had some practical use in their daily lives (Fennema & Sherman, 1978); the girls continue to view mathematics not to be linked to their structure of thinking. If girls continue with mathematics, they are likely to have a tendency of showing that they dislike the subject and liking the subjects highly contributes to succeeding in it (Lockhead et al. 1985).

I am of the view that schools play a pivotal role in allocating or withholding opportunities to students by identifying their ability level. The fact that the message is received differently by males and females, this can negatively impact on female students. This is because male students may be seen as naturally fitting in. Females' conformity to expectations of silence might impact negatively on females verbal interactions.

According to Trentacosta and Kenney (1997), just like males, females should not be denied access to learn mathematics at a higher level. A closer look at higher level mathematics indicates that this subject is appropriate, relevant and essential in the lives of both females and males. It is extremely important that teachers scrutinize their acts of thinking that a certain group of people can learn mathematics. It should be clearly understood that mathematics is not only meant for students who will follow more prestigious careers. Mathematics has serious implications for the overall being of an individual. Mathematics also utilizes different mechanisms in acquiring skills and knowledge, which they use in their personal, professional and occupational lives.

Murphy & Gipps (1996) furthermore emphasize that society must not forget that women have been subjugated and negatively socialized by male dominant society. The inequalities experienced by women all over the world have been traced back to socialization and sexism, particularly in the education system. The society's conception in the neutrality of the subjects such as mathematics has been inaccurate. By not taking women or gender into account, what can be used to constitute relevant knowledge might be at the very least incomplete.

3.1.4 Teachers' differential interactions with students

One way in which the students, particularly of the same age influence each other is through the interactions, which they have in the classroom. Wenzel, (1996; 2003), suggests that in the classroom students or pupils of the same age usually behave the same way because of the developmental stage, they are at. They usually use this to achieve goals and skills, through interacting socially with their age mates. Hayes & Flannery (2000) discovered that the major difference between males and females with regard to mathematics is not ability per se, but rather the extent of positive exposure to the subject. Girls and boys with identical mathematics backgrounds show little difference in performance on mathematics tests. Yet girls are less likely than boys to pursue mathematics training beyond their schools' requirement for graduation. Two critical factors which influence their decision appear to be their interactions with teachers and the encouragement of their parents. They also report the likelihood of girls

more than boys as citing a teacher as the factor that most discouraged them from studying mathematics.

Research on teacher-student interaction indicates that there are various ways, that teachers differently reinforce mathematics achievement in male and female students. This solemnly by perceiving and conveying the belief that mathematics is more essential in the lives of males than females. Some of the observations are that teachers encourage girls to become proficient at computational mathematics and boys at problem solving. Teachers also were observed to be calling on boys more than girls to solve problems in class.

Bias in teacher-student interactions are solely results of teachers' perceptions, however, girls and boys might have acted in different ways, thus evoking different responses from teachers. Some researchers claim that women learned language in ways that differed from men and that reflected women's subordinate role in society. Women might not find it easy or natural to express their ideas in the forceful, argumentative way that often is necessary if their contributions are to be taken seriously in classroom discussions.

This is further supported by Weisbeck (1992) that when gathering data through interviews which were based on teachers remembering and recollecting thoughts on what actually happens in the classroom. Interestingly teachers reported thinking more about boys than girls during teaching and learning. They however recalled that the same characteristics were basically used to describe boys and girls. It is imperative to note the fact that teachers are cautious if they are interacting with a male or female student. Nevertheless, teachers did not attribute any vitally essential distinguishing features of males and female that should be considered to be infused when making instructional decisions. Teachers' reactions were attributed to pressures of life circumstances that they encounter. The teachers reported that the boys are apparently conspicuous in the teachers' thoughts.

In general most teachers think they treat students equitably, but this is not reflected in the reality of the classroom. For example, Sadker and Sadker, 1994; Fennema and Leder, 1990; Jungwirth, 1991) observed that the boys were asked more questions of higher order learning and boys and girls are criticized differently. It was noted that males were criticized constructively rather than negatively. This observation was irrespective of the teacher's gender. Smith and Glynn (1990) differ as they state that teachers are more likely to interact with children of the same sex as themselves.

Jussim and Eccles (1992) in agreement stated that there is no doubt that there are disparities, when looking at interactions between students and teachers. These disparities have been supported by the formal or official curriculum. Teachers were seen to behave somewhat different when they are sensitized on the classroom interactions which were seen to support gender imbalances. This was a study carried out by Gould (1995). The study also posited that teachers on a conscious level did not favor any particular gender. The teachers rather exhibited hidden messages that they transmitted to students as they interact with them.

Fennema and Leder (1990); Eccles and Blumenfeld, (1985); Peterson and Fennema (1985); Fennema and Peterson (1986) set the scene by pointing out clearly that the way the teacher differently interacted with males and females can be easily pinpointed during the classroom interactions. Teachers have also been said to contribute to gender-bias in the classroom, as teachers do not distribute their attention evenly among boys and girls. That is to say teachers interact with males more frequently, ask males better question, do follow up questions and give them more precise and helpful feedback. They argued that the differential treatment of boys and girls cannot be definitely determined since their effects are not more visible enough to build a strong argument. They continued to argue that there is little information that supported that supported the argument that the academic differences observed between males and females can be attributed to the differential teacher treatment during mathematics learning. Gipps and Murphy state that in 1995,

“There is still insufficient data on which to base proof that teacher’s differential interactions with boys than girls is a major contributor which should be considered in the development of gender, particularly in mathematics” p.74).

This is disputed by the statement that, the evidence is out there, boys have greater opportunity in mathematics and teachers call on boys more often than they do with girls (Kaplan and Aronson, 1994; AAWU, 1992; Hart, 1989). The teachers’ behaviors contribute to this pattern of the teacher interacting more with boys openly and hence received more precise and helpful feedback. This practice turns to overlook the confidence possessed by girls in mathematics.

Although teachers found that, qualities which contribute to the success are the same for both females and males; it was evident that the ability of teachers to recall which male students are more successful was seen to be accurate. This was not the case with teachers when it came to recalling the girls who were successful. Many teachers are seen to be unaware of their own discriminatory behaviors. This included such thoughts as the attributing girls’ success to them putting extra’ effort in their studies. Whereas in the case of boys their success attributed to ‘ability’ rather than extra effort.

Teachers do not enter into mathematics lessons to teach in an equitable manner. This is evident since girls in most cases have their abilities going unnoticed particularly in mathematics and science. This practice limited their prospective chances. Despite, the advantage that girls have of being identified for gifted programs, they usually drop off at the secondary level at a higher rate than their male counterparts. This could be attributed to too much peer pressure at that stage, which results in girls concealing their intellectual ability in mathematics. It should be noted that teachers have not exhibited a more detailed and an up-to-date classroom interaction record, keeping analysis of their interactions with male and female students in the classroom. This analysis will throw a new light on gender and classroom interaction

Eitzen and Maxrueb (2000); Jungwirth (1991), have argued in favor of what other authors have said; that despite boys and girls being in the same classroom they are seen to be amazingly receiving different education from the same teacher. This is because teachers have different expectations for females and males during mathematics. In addition, there is an uneven distribution of contact time by the teacher to male and female students. Research has found that getting the teachers' attention depends on how the students act to solicit the teachers' attention. It can be seen that girls who get more attention are usually very close to their teachers. In addition, there was a different observation here, since boys who are aggressive received more attention than the female students who displayed the same characteristic of aggression

In addition, Davidson (2002) states that, other forms of inequalities have been visible in the classroom. This cannot be overemphasized, among many of these practices are; investing more time when dealing with male students. Contrary the teacher; however, in case when it is female students their time will rather be saved, either by solving the mathematical problem for the student rather than to give logistics about how to go about the problem. This outcome of the practice is that boys become more independent than girls. To nature a Childs' strength and survival skills begins fairness in the classroom.

Teachers are unaware that they give males more attention and surprisingly that attention is uncalled for and hence unaccepted by the boys. In the case of girls the lack of attention may be not be eye catching or disturbing, and even unrecognized for some girls. For some girls the lack of attention may be envied and desired. Hence, the implication is that this could be detrimental to the lives of females if taken for granted. There might be a relationship between the attention that the teacher gives and the students' academic performance. Girls are likely to benefit since they are deprived of enjoying this benefit which is seen not to be negotiated for by male students (p.2).

Clark (1990); Walden & Walkerdine (1986); Francis (2002) argue these teachers' differential treatment from a power imbalance, point of view. To these authors, boys and girls have different ways available to them of being powerful. Boys have access to direct challenges of the authority of the teacher. Girls are usually denied power indirectly. This usually pronounced as girls are observed as, being a quiet, cooperative pupil or taking on the role of the teacher, a role that should not compromise their femininity. Hence, by being positioned like a teacher and sharing her authority, girls are enabled to be both feminine and clever. These give them considerable prestige and help their attainment.

However, the circulation of power is not as straightforward as seen it on the surface. Girls may gain power in taking up this position, but being like a teacher also means becoming nurturing, helping others, being sensible and mature. This is the authors' point of argument that being like a teacher may actually mean an abdication of power. Clark strongly argued in her research that 'girls' sensibleness or maturity meant taking a back seat. This result in the classroom interaction and teacher attention being dominated by boys. Consequently, this may impact negatively on the learning of mathematics by female students. It cannot be disputed that mathematics learning

requires validation of answers and this can only benefit the female students if power that girls possess is not contributing to their disadvantage in learning mathematics.

According to Baloglu (2003); Trujillu and Hadfield (1999) mathematics, teachers are faced with attitude and emotional problems that could be attributed to tension due to apprehension of mathematics. Yes, attitudinal and emotional issues cause mathematics anxiety in girls and that anxiety comes from socialization and differential treatment.

The authors seem to reach a consensus that teachers interact differently with male and female students. They differ in the sense that some are of the thought that the differential treatment does not contribute to gender differences in mathematics. This kind of behavior might not be peculiar to Botswana, given the assumption that equality is incompatible with the difference, that the idea of gender equality mandates the same educational treatment for girls and boys.

3.1.5 Interactions between male and female students

Eccles and Roester (2003); Skelton, Francis, and Smulyan (2003); Redpath and Claire (1989); Krupnick (1985) suggest that the differences between males and females become visible when they interact in a group rather than when they are alone. They also emphasize that the effect of dealing with individuals of approximately equal age and social standards is disputable. This underpins procedures and activities of how learning occurs in the class, including prospects of accomplishments that challenge students in schools. This include among many, male students as individuals tend to be described as good students. This is because individuals display such behaviors as, staying on a task and being obedient. This is contrary to when they are in a group, where they show independence, assertiveness and aggressiveness, toughness and competitiveness. Boys are mostly, challenged by tasks presented by other boys.

AAUW (1992) indicate that boys in small groups are more likely to receive help from girls when they asked, but that girls' requests are more likely to be ignored by boys. The teacher must therefore constantly monitor the groups' activities not only for mathematical content but also for the group dynamics to ensure that gender inequalities and injustices are not perpetuated. This tendency will ensure that the qualities of female accomplishment are not weakened.

Eccles and others above have noted that even if there is a difference between males and females, there is somewhere where their behavior partly coincides. Realistically there are girls who are active than boys. Research shows that averagely boys are more active than girls at school age. Also, it has been observed that in the classrooms males are likely to be more active than females. Comparatively girls who are active do not demonstrate it in a more forceful way like boys.

Irrespective of class, girls express a good deal of anger, annoyance, and frustration with school, often focusing on teachers who they feel ignore them or attend to unruly students, usually boys, or who abuse their authority in the classroom. Also, gender

differences in communication and interaction patterns may hinder effective cross gender group dynamics.

Because of the insensible nature of classroom interactions, teachers are often not aware that they are only teaching males. This is because they respond to male students' peremptory request for attention without conscious thought. If teachers, are convinced that participation, is an indication that learning is taking place. It is most likely that females will be ignored since their participation level in class will be lower than that of males.

An analysis of the classroom interactions in different settings for children aged 9 and 11 demonstrates that male students speak more frequently than female students. A college study revealed that male students dominated discussions and they speak longer. This continued even in their old age years. Females on the other hand are more likely to ask questions. They also avoid interrupting other speakers and will appreciate comments from other speakers. To some teachers these may suggest that, female students do not have authority over the predominant topic.

It should be noted that the way students conduct themselves is in agreement with the sex role behaviors that compromise the confidence of women. When the trends of participation for females and males are compared, it is likely that teachers treat female verbal communication in a less dignified way. Since, this could suggest that girls demonstrate less command in the subject matter. Teachers are unaware that they pass inappropriate messages of what is expected of girls.

I shall argue that the aim of any teaching method is to ensure that the environment suitable for learning prevails. All students should be part of the learning process through participating. Participation is an important component of learning as students who learn more are those that participate in class. The teacher must strive to create a productive environment that will promote balanced interaction between females and males.

3.1.6 Teaching and learning approaches favoring males

According to Skelton et al, (2006) various groups that advocate for equality of women point to the part played by socio-economic practices and expectations rooted in the recognized system and the social institution which tends to restrict women's lives and behaviors. There have been theories which point to the role of the social institutions in producing such behaviors with formal education playing a central role in perpetuating these inequalities both in terms of access and performance.

Teachers set the accepted or approved way for a formal classroom. This adheres to cultural practices and beliefs that normally influence how males and females are viewed. These practices tend to put males at an advantage. The environment can be viewed as not welcoming for girls. (Sandler, 1982; Kramaerae and Treichler, 1990).

Kramaerae and Treichler (1990) also found trends in which the behavior of teachers and the way the classroom was organized, tended to influence male and female students in different ways. It was observed that competitive activities encourage learning particularly in boys. This kind of method is not suitable for female students as it affected their learning in a negative way. Distinctively, females are seen to be favored by cooperative activities, where students work as a group to do a task. It appears the majority of classrooms being studied has competitive activities being practiced than the cooperative ones. These kinds of classrooms are often favorable to the way boys learn.

According to Vygotsky (1978) observed that putting students in small groups and giving them an experience of cooperative learning, help students to examine abstract ideas in mathematics. This also encourages scenery where students solve problems, through interacting with each other. It has been revealed by research, that when students interact in a group or are involved in what we call cooperative learning, their self-esteem, motivation and academic achievement, is improved. In addition group discussions have been found to encourage the growth of mechanical operations or process which involves the mind especially in children. This is because when looking at children they usually work cooperatively among themselves about what is discussed in a group.

Slavin (1986) also found that group discussions resulted in working relations of classmates being improved as a result of change in behavior towards each other. This is because the students develop the skill of valuing what other students say, as worthy and to appreciate a degree of distinctiveness as part of them.

3.1.7 Teaching and learning approaches favoring females

According to Trentacosta and Kenney (1997) the atmosphere in the classroom should be a non-threatening one. It should provide the necessities of life. In addition, it should help students to investigate, make judgments, decisions and form conclusions. Students should take pleasure in studying mathematics and should view it as being useful in their lives. The use of varied teaching methods that build on students' background knowledge and understanding of ideas presented in mathematics, promotes students reasoning capability and their problem solving skills.

According to AAUW (1992); Ong (1981); Fennema and Peterson (1985); Fennema and Peterson (1986) and Hanna (1996) evidence exist that males and females [learn using different approaches. The reasons for these differences continue to be discussed. Women are seen to achieve more in a more collaborative, less competitive classroom environment. The mode and content of past classroom instruction during mathematics is more attractive to western male students in particular, since it fits their learning style and cultural background.

For many girls and young women successful learning takes place in an atmosphere that enable students to enter emphatically, into mathematics. This can be through diverse knowledge and the interrelationship of thoughts and actions. This is not the only

methodology to achieve connected teaching. Using collaborative small groups is one of the best ways to accomplish several goals. Some men however, do equally well in a collaborative environment.

Horgan (1995); Fennema and Ledger (1990) stated that developing the students' voice and ability to learn autonomously is seen as to be essential for it eliminate gender differences in mathematics. In groups, students develop and support their own justifications, struggle for solutions to problems and share problem solving. More challenging problems can be chosen because a group has the benefit of several minds working towards a solution with guidance from the teacher; students in one group can carry out investigation in greater detail.

On a different note, Hyde et. al (1990) was questioning as to what actually happens within those small groups. This influences how mathematics is learned, especially when dealing with abstract mathematics. It is important to note that the learning of mathematics cannot be judged by merely engaging students in small groups. What is more important, is what the girls think about as they engage in cooperative activity.

Murphy and Gipps (1996); Campbell and Wahl (2002) take a different approach by proposing single sex, secondary schooling or single sex mathematics classroom instruction as an important step in addressing gender issues. This was also supported by Lee (2002), who argues that single sex, secondary schooling might in fact, sensitize young, female of their occupational and societal potential in an atmosphere free from the pressures of mixed classrooms that are characterized by sex-stereotyped distractions.

They assert that mathematics learning for girls in single sex schools thrive much better than in co-educational ones. Lee (2002) also argued that students in girls' schools show higher levels of association with peers and positive interest in mathematics learning.

Jones (1985); Serbin (1978); Jungwirth (1991); Lee (1990) and Winfred (1993) also report that the co-educational context give boys the environment to use verbal and non-verbal strategies to bully girls and render schools as dangerous anti girls' space.

If boys and girls are so different in their educational styles and needs and if it so difficult to create true gender equity in the classroom, then it makes sense to separate them altogether. This is catching since it widens the lens of looking at the fact that males and females learn and perform differently.

3.1.8 Gendered seating arrangements

According to Gordon et al. (2000); Crosnoe, Caranagh and Elder (2003) within the context of the school, classrooms constitute particular spaces of their own and have different characters at different times. Classrooms cannot be treated in isolation from the society since schools are found within the society. Many factors which work together to influence the behavior of students and how they learn in the classroom are embedded in the society from which it originates.

There are the primary spaces for teaching and learning, but also often territorially marked as belonging to a particular teacher. Generally teachers are in control of this space in a number of important respects. They are able to control who is allowed into this space and when they may leave.

The furniture is arranged in particular ways that bespeak the kind of teaching that goes on, in single file, pairs, or joined up together for group work. Students sit near each other in mathematics, classrooms according to the desk arrangement, teacher direction and social norms. Whom, the students sit next to expose them to a number of influencing beliefs and behaviors that allow a context to emerge with regards to the norms, values and standards that concern academic motivation and achievement.

According to Bailey (2002) children are often deprived of the choice of where to sit but are given a space or refused permission to sit in another space. Thus, bodies are controlled and this regulation often occurred in sex- stereotyped and sexualized ways. For example, boys and girls may be made to sit next to each other in order to discipline the boys and control their behavior.

Thus, the boys are viewed as being more active, malicious and cause disorder in all aspects. The girls on the other hand are viewed as being responsible and calm as they are obedient and take instructions.

Sharma (2003) states that

“To have a favorable outcome from seating arrangement, interactions should be facilitated, and access to instructional material should be easy. Seating arrangement is important as to how the classroom is relatively used and also to control the movement of students in class”.

Emmer, Evertson and Worsham (2006); Aydin (2000); Traynor (2003) state two broad ways as to how the classroom can be arranged, this could be simply, teacher centered or student centered. When using these two methods, teachers and students use strategies to arrange seats in the classroom, and these are coercive, laser fair, task oriented, authoritative and intrinsic. This usually depend on how the teacher wants to achieve their instructional objectives and also considers how the students themselves want to learn, which make it easy for them to choose the strategy which would fit their learning styles. But in teachers tend to overlook the needs of students and the instructional objectives to be achieved.

Evidence is out there, that during mathematics learning, students are observed to be affected by who they sit next to. These could be viewed in terms of the other student's behavior disrupting and distracting them. The students report a greater level of discomfort in mathematics due to the seating arrangement. This was seen to affect student talk, both in terms of discussion and help, particularly if a student's learning style is to talk about mathematics (Jill interview, 2006).

3.1.9 Gendered seating arrangement in the African context

Discussing the issue internationally, especially looking at western countries. It could be argued that one way to change the surrounding in which learning occurs and prevents problematic behaviors that are not accepted, is by arranging the physical environment. Even though, this is only just one way of doing it. It has been shown by research concerning the classroom environment that behavior of students and teachers can be affected by the physical arrangement of the classroom (Savage, 1999; Stewart & Evans, 1997; Weinstein, 1992).

There is basically good reason why teachers strategically place students with behavior problems or any known special need near where the teacher sits (Bettenhausen, 1998, Wolfgang, 1996). Shores and his colleagues (1993) recommended that strategic placing of students with behavioral problems and special needs should be done to ensure that the teachers positive statements intended to correct behavior are delivered. Hence, this should not be used only to monitor behavior. They continue to argue that just as other aspects of instruction, the cultural and linguistic characteristics should be considered as providing important background information that might be considered when arranging the classroom, since it reflects on how the classroom is physically arranged and should take into consideration the specific needs of each individual.

I tend to see a different perspective when looking at the Gendered seating arrangement in African context. Contrary to that, the seating arrangement is determined by the teacher post the problematic behaviors that have occurred in class before, not to ensure that positive statements intended to correct behavior are delivered. This is the power that is used by the teacher to influence student behavior. That is to say troublesome males are placed next to girls to try and control their behavior. The latter practice usually perpetuates the male dominance in mathematics classrooms due the realization by males that their disruptive acts are given so much attention. This is usually done to with the intention that the female student is used to ensure the correct behavior of the male student, and not taking into consideration the Patriarchal practices of the African culture, which these students have been socialized through encourages male dominance. Hence arguing on this ground rejection of diverse culture may be an obstacle in considering the specific need of female students.

Abosi and Kandjii- Murangi posit that in the African context, using Botswana's classroom setting as a specific example that;

The classroom, like the school, has the features of a society. It has peer, leaders, deviants, social hierarchy and interpersonal problems. The classrooms have been rightly called 'a mini society'. These social features have to be considered by the teacher who must interact with children in a manner that is conducive to their learning. The pupils form their opinions about the teacher in terms of strict or soft, effective or ineffective, democratic or authoritarian, laser-fair or disciplinarian. Discipline and the maintenance of order appear to be the main pre- occupations of the teacher. 'The classroom can be compared to a cage; the pupils wait and experience 'delay, denial and interruptions'. Here the most useful quality that a student needs to cultivate is

patience. The structure of the convectional classroom is not conducive to active involvement of most students; it promotes distance and distrust between students and teachers (p. 91-92).

I believe there is need for more learning contacts with the international world, which have advanced in education. There is need to see the classroom arrangement to be democratic whereby students choose where to sit taking into consideration the cultural diversity and learning needs of the individual students. Hence the seating arrangement should not be permanent and should be changed in order for the teacher to achieve her or his aim.

CHAPTER 4: DYNAMICS OF THE ANTICIPATED RESEARCH

4.1 GOALS OF THE RESEARCH

The purpose of this research is to establish the extent to which gender dynamics in mathematics learning impacts on teaching and students' learning in selected Botswana primary schools. This study seeks to investigate and analyze patterns of gender inequalities during mathematics lessons.

4.2 OBJECTIVES OF THE RESEARCH

- To examine gender dynamics in mathematics learning or teaching of Botswana's standard six primary students.
- To identify the differential teacher interactions towards male and female students.
- To identify how the approaches used for teaching affect the learning of mathematics.
- To identify the differential interactions of male and female students during mathematics teaching/learning.
- To examine how seating arrangement is gendered in mathematics teaching/learning.

4.3 METHODOLOGY

Feminist research methodology and its philosophical underpinnings emphasize the study of women and seek to put women's voices and experiences at the center of scholarship discourse, or right the wrongs of the major disciplines such as sociology, which ignored the presence and contributions of women in the social world. Addressing the issue of what made a particular piece of research specifically 'Feminist', they found that it included incorporating gender, privileging subjectivity, avoiding exploitation, and empowering women.

"Looking at all kinds of feminist theory, it will be realized that they have something in common which is portrayed in diversification of women's lifetime stories that women provide" (Lugones and Spelman, 1990, p.21).

Even though there is a fundamental recognition of differences in social location. There is need for rearrangement of society in a manner that will give first priority to the experiences of women. This will mean putting women's experiences as the fundamental building block of feminism, recognizing that the world that we live in is organized according to gender. This should not be mistaken to mean that feminism could be singled to be a theory which brings together all theories. Instead, it should be noted that the main aim for all feminists, to theorize is that they have in their mind, gender as their center of attention or as the core of a discourse. This is evident in Patrick Maguire who summarizes everything in coalesce that "basically feminism is a belief that women are faced with some form of affliction or are being tormented as they are always taken advantage of. This will further entail an obligation to disclose and know more about what causes, maintains and prolongs all forms of oppression. This would result in a call for a

promise to pledge to work together in all our daily activities, and encounters with life on how to end this form of torment and affliction brought on women” (Maguire, 1987, p.79).

This author did share a commonality without exception with the other authors Lugones and Spelman and Maguire. Further feminist research was concerned with the taken-for-granted unequal power relations in conventional ways of doing and thinking and sought to remove this to render the process a two way process, in which all parties in partnership respect the others’ contributions. This means, the power imbalance between the researcher and the respondents are transformed to confirm or corroborate the perspective of the researched. Changing research terminology is one the important political methodological steps that feminist research took in the transformative paradigm. Thus research served to satisfy the needs of women and not just as a tool to give approval to the domination of the males in the world that we live in. With this practice, where partnership is taken into consideration, I strongly believe we could go far in research and in taking the world to greater heights if we adopt the feminist scholarship, as this has a lot to offer in research and also in broadening the body of knowledge.

Feminist research took the political stance of liberating women from patriarchy, capitalist class system and elitist oppressive political and economic systems. It also sought to liberate all oppressed groups in society from the throttles of gender, race and social class, sexual orientation, gender identity, religion and age based discrimination. It is important to note that, these various feminists defined themselves as focusing on strategies for liberation of women differently (Letsie, 1992).

At a philosophical level, feminism challenged the totalizing or hegemonic nature of positivism, seeking instead to borrow from relativism, post structuralism and postmodernism which are philosophical traditions that among others take the political view that there is a multiplicity of truths and realities, and that these, whatever their origin, are valid in their own right (Letsie, 1992).

Philosophically feminism sought to transform ways of thinking, doing and knowing in the quest to render every individual equal and worthy of all political and socioeconomic rights. Primarily feminist research took the view that women have historically been excluded and marginalized to the advantage of men. This has been done through deliberately contrived ways, from political and socioeconomic structures of society. This also included the distinctive way of knowledge creation in this scholarship. Feminism asserted that research as a tool of knowledge production, has a strong masculine orientation. With the fundamental assumption that, men were the frame of reference. The criticism brought by feminists was that, what applied for men could be generalized to women (Letsie, 1992).

With the aim of emancipating, the term transformative paradigm was adopted to describe a family of research designs and methodologies which are controlled by various philosophies and theories with a common idea of liberating and changing communities. This would be done through working together as a group. In the

transformative paradigm, the purpose of research was to put to an end the myths, deceptive impressions of reality and knowledge that are not in anywhere near to the truth. This would seek to empower people to act to change the society that we live in. To enhance the credibility of the study methodological triangulation was used for easy presentation of findings. (Mertens, 1998).

CHAPTER 5: RESEARCH METHODS

5.1 STRATEGY AND TECHNIQUES

5.1.2 Researcher's position

No researcher can ever claim to be value free and untouched by influences emanating from her social class, gender, race, ethnicity, sexual orientation and gender identity locations. All human beings as social animals carry preconceived ideas from social, political and social relations around them. It is always important for the researcher to interrogate these in every setting and make an honest reflection of how these affect research processes and outcomes (Letsie, 1992). This study which looked at pre-recorded digital versatile discs (DVDs) of classroom observations still demanded the same level of interrogation. The researcher had to question her responses in order to exclude as much personal bias as possible.

5.2 DATA SOURCES

In the transformative paradigm, the aim of research is to put to an end any unproven beliefs, acceptance, or impressions of reality and knowledge that is not true. This would seek to empower people to act to change the society that we live in. To enhance the credibility of the study methodological triangulation was used for easy presentation of findings. Botswana, primary schools were analyzed using data from the Human Sciences Research Council (HSRC) - Stanford University - University of Botswana Regional, Education Study, which looked at a comparative study on teacher quality and student performance. Pre-recorded digital versatile discs (DVD's) were analyzed to tease out teacher and students, differential interactions as well as analysis of the seating arrangement in mathematics classrooms.

5.3 DATA COLLECTION

The data which was used was collected which was in the form of pre-recorded digital versatile discs (DVD's) was collected between 2009- 2010. The title of the study from which I obtained data is HSRC- Stanford – University of Botswana Regional Education Study: A comparative Study on Teacher Quality and Student Performance in Southern Africa (Excerpts). Their study focused on mathematics learning.

An instrument in the form of a checklist was used. A checklist indicated whether something was there or not. This required a gender audit of the mathematics classroom environment to be done. The following checklists were used: Appendix A: gender bias, seeing gender, Appendix B: A gender classroom audit: See gender and Appendix C: Seeing Gender classroom observation protocol.

The pre-recorded digital versatile discs (DVD's) from the eight Kgatleng and South East districts primary schools were only available data and all these schools were either urban or semi urban hence this limited the scope of the study. Further research involving a sampling from all regions would broaden the scope of the study.

The targeted population of my study was standard six primary school pupils. Eight schools, whose mathematics lessons were recorded, were the focus of the study. These were named schools A-H, to prevent using the actual names of the schools in the interest of confidentiality. The available pre-recorded digital versatile discs (DVD's) were from the South East and Kgatleng regions.

Table 1 showing the population used in the study.

SAMPLE	SCHOOLS								TOTALS
	A	B	C	D	E	F	G	H	
The number of girls	9	19	9	15	10	6	15	10	93
The number of boys	18	24	15	18	20	17	12	17	141
The total number of students	27	43	24	33	30	23	27	27	234
Gender of teacher	♀	♀	♂	♀	♀	♀	♂	♂	5 ♀ 3 ♂
									8 teachers

A key

♀ - female

♂ - male

5.4 VERIFICATION

Confidence had to be placed on research studies by researchers and consumers in the case of procedures used in analysis and interpretation, findings and conclusions. To ensure rigor and credibility, transference and dependability of this qualitative research study, the following were taken into consideration.

5.4.1 Peer debriefing

Discussions were held with peers on the procedures for the study, research questions, findings, analysis and conclusions. Peers posed searching questions to help the researchers confront their own values and to guide the research process.

5.4.2 Negative case analysis

During the data gathering and analysis unexpected findings which did not match the researcher's preconceived ideas were not discarded and were truthfully reflected.

5.4.3 Triangulation

This was another strategy for enhancing the credibility of a study. This entailed integrating quantitative and qualitative approaches. This entailed the use of graphs and tables for illustrations.

5.5 DATA ANALYSIS

The purpose of the study was to establish the extent to which gender dynamics in mathematics learning impacted on students' performance in eight Botswana primary schools. This chapter presents data analysis on gender dynamics in mathematics learning looking at what actually happens in the classrooms. The findings are presented according to themes that emerged from the gender bias audit of the classrooms (Appendix A, B, and C). The themes that emerged were; stereotype activation by teachers, domination of the classroom by male students, competitive approach used for teaching; cooperative approach used for teaching, the female and male students' interactions and gendered seating arrangement. Schools which had the same themes were grouped together.

5.5.1. **Stereotype activation showed by teachers Schools A, B, E, F and G.**

Teachers perceived and conveyed the belief that mathematics was more important for boys than girls. Male students received more precise feedback from teachers' praise. Teachers encouraged boys to become proficient at problem solving. Teachers' ways of reinforcing achievement in mathematics was different for the female and male students. Teachers called on boys more than girls to solve problems in class. It was realized that female teachers gave male students more attention. Teachers specifically, interacted more with boys and praised them. Boys talked more than girls in the classroom. Boys got the teachers special treatment by uttering answers loudly and they were not admonished for that. These practices encouraged boys to continue taking risks, even at the workplace long after years of schooling.

Different responses were observed when boys uttered their answers loudly as they were not rebuked formally. In the case when it was girls uttering answers loudly there were cautioned about that behavior. Teachers accepted boys calling out while girls were expected to patiently await their turn. This may be seen as discouraging girls from taking spontaneous risk-taking. This sent a powerful message that teachers tolerated calling out by boys but disapproved when girls did so.

There were some negative attitudes about female mathematics achievement held by teachers. Teachers reacted differently to girls and boys; they seemed to have different kinds of contact and expectations from them. Boys interacted more with their teachers publicly and therefore received more positive public evaluation and constructive feedback. Teachers were willing to spend more time with male students as they explained a problem. Girls' abilities were overlooked as teachers solved the mathematics problems for girls instead of giving out detailed explanations.

Female students did not express their ideas forcefully in an argumentative way. This resulted in independence being internalized more powerfully in boys than girls. Boys

had access to directly challenge the authority of the teacher; this was seen as they expressed their ideas forcefully in an argumentative way. For example, the boys would say 'this girl is wrong' and the teacher gave them a chance to express their ideas. But girls did this indirectly by keeping quiet when a boy gave a wrong answer.

Teachers exhibited gender favoritism in the language that they used with their students that is not comprehensible and difficult to detect and analyze. For example, comments like, "*very good my boy, got it my boy; good boy, please clap hands for him, girls come on boys are ahead of you*". Also when the boys started raising their hands, the teacher said, "*did I teach only those who are raising their hands?*"

In addition to the above mentioned similar trend, these were also observed in school A. A male student with a jacket written 'boy' at the back was the center of attraction, this excited the class as seen from the attention he got from other students whenever he was chosen, and this was many times, to perform a class task or answer questions. First to define 'area', secondly to demonstrate where the surface of the door was, since he was one of those who raised their hands. This made the boy overconfident at this level of attention. It could be seen that the teacher did not concentrate on those who did not raise their hands, and most of these were females.

In school F. it was observed that at the beginning of the lesson a male student stood up and walked to and from the board just to get the attention of the class, another male student just stood up at his desk just to get the attention of the class. The teacher did not call these boys to order.

5.5.2 Stereotype activation not shown by teachers for Schools C, D, and H.

These teachers endeavored to deal with students equitably. It should be realized that fairness in the classroom may not occur without conscious thought. The teachers were seen not to favor any gender when they were aware of their surroundings and thought. Both female and male students participated freely and were provided with equal opportunity to tackle assigned work. This was reflected in equality when it came to asking questions and receiving positive feedback of male and female students.

5.5.3 Classroom interactions dominated by male Students at Schools A, B, E, and F.

Teachers tended to ignore female students as their participation level was lower than that of their male counterparts. Teachers were not conscious and aware that by these practices they were focusing on teaching male. This is because years of habit pulled them towards same teaching styles and they responded automatically to male students' demand for attention. Teachers directed more questions to the boys than the girls.

Even when females participated in the classroom talk their body language suggested they had less command over the subject matter. The girls spoke slowly in soft voices although there was one or two who spoke boldly and assertively. In general, it was evident that males dominated classroom interactions and teachers unconsciously made the girls invisible. Most of the girls took a backseat in classroom interactions.

Figure 1 showing the frequency of a female teacher choosing the girls and boys to answer questions in class in school A.

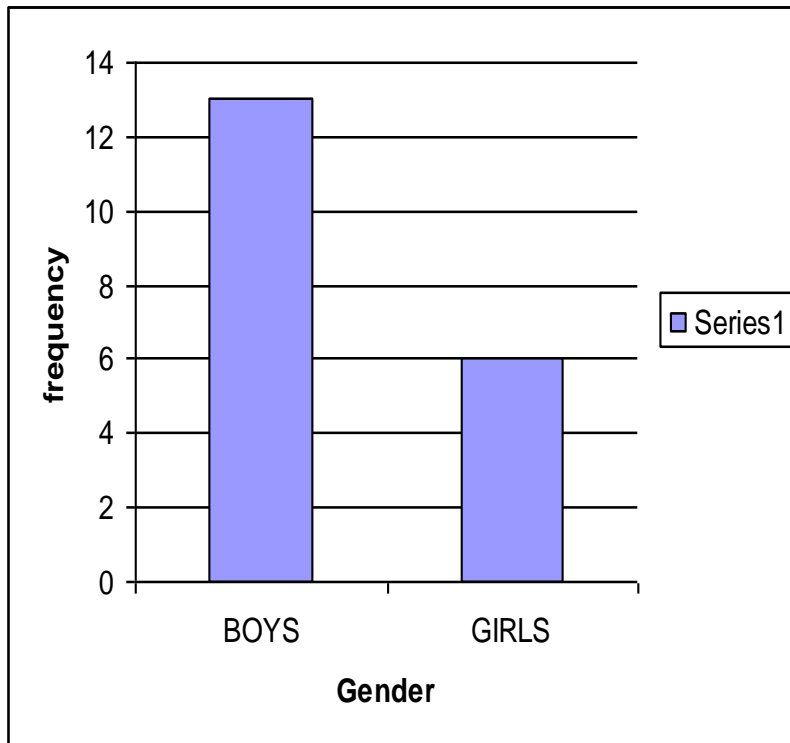


Figure 2 showing the frequency of a female teacher choosing girls and boys to answer questions in class for school B.

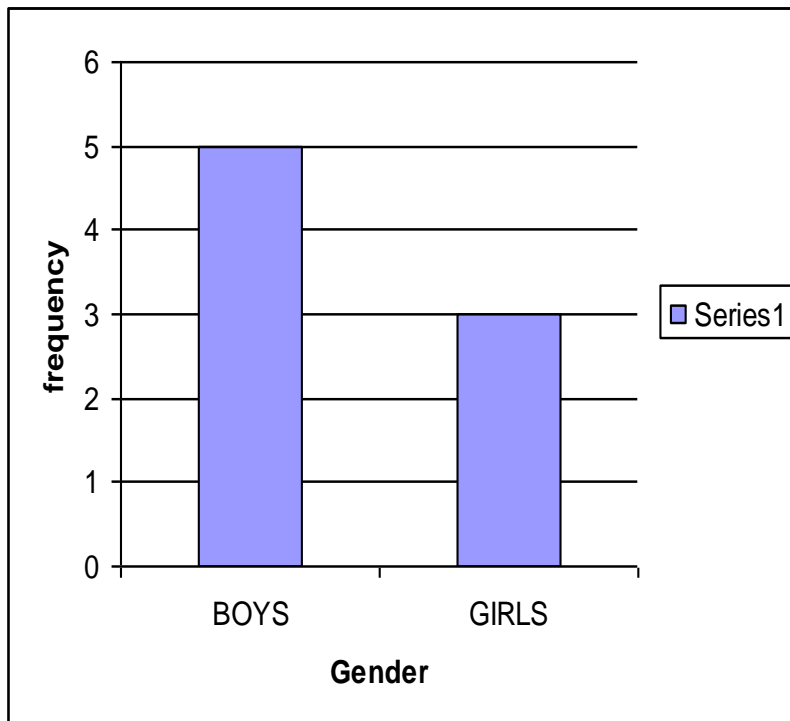


Figure 3 showing the frequency of a female teacher choosing girls and boys to answer questions in class for school E.

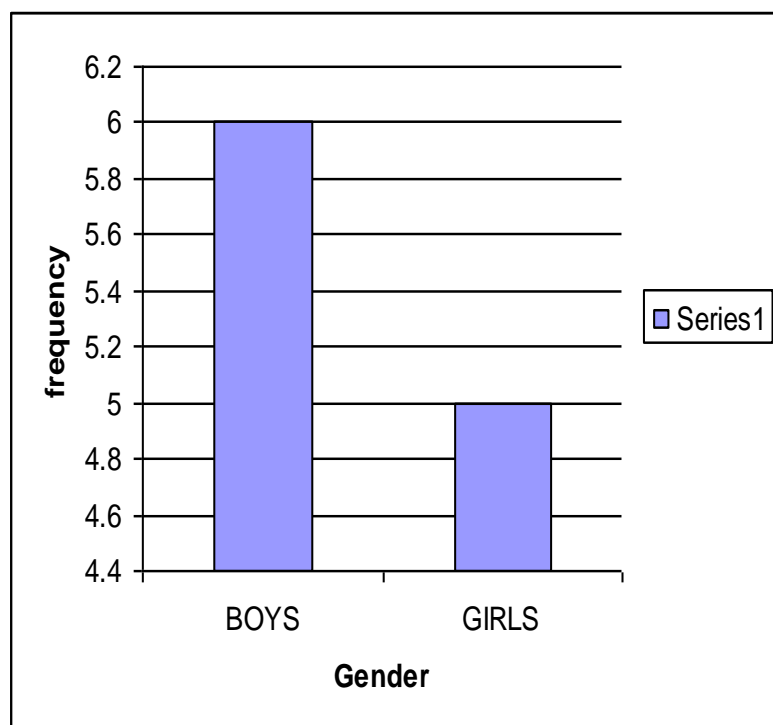
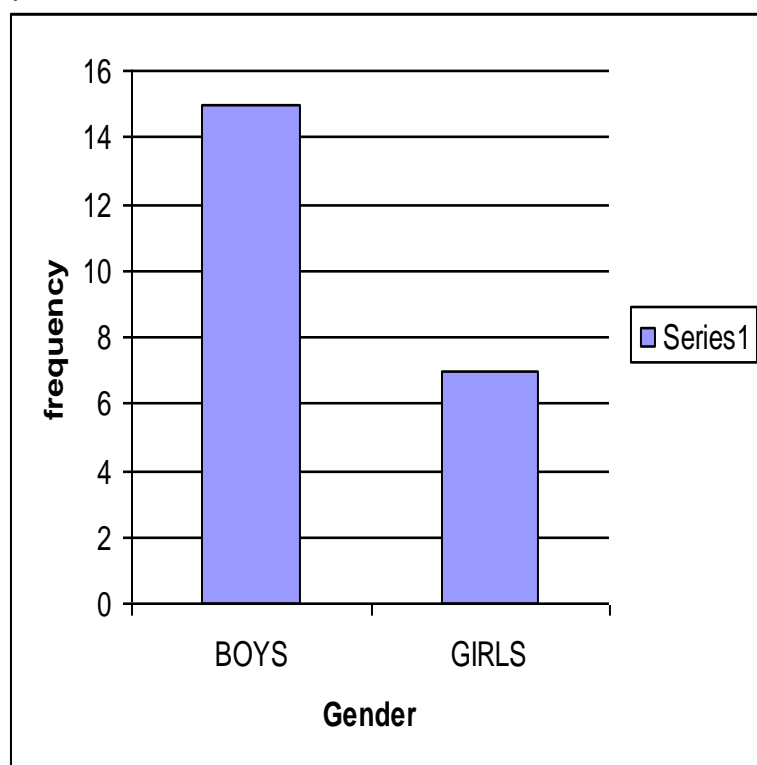


Figure 4 showing the frequency of a female teacher choosing girls and boys to answer questions in class for school F.



5.5.4 Classroom interactions dominated by female students in Schools C, G, and H.

Girls who were physically close to their teachers received more attention than the boys. Girls were encouraged to become proficient and were called on more than boys to solve problems in class. The classroom was a non-threatening, supportive place that encouraged female students to participate.

Figure 5 showing the frequency of a male teacher choosing girls and boys to answer questions in class for school C.

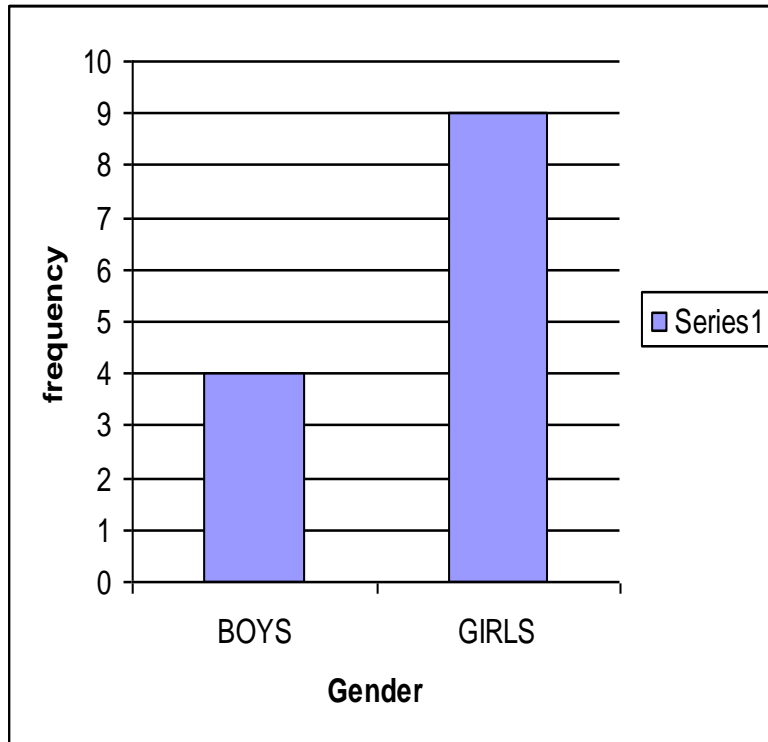


Figure 6 showing the frequency of a male teacher choosing girls and boys to answer questions in class for school G.

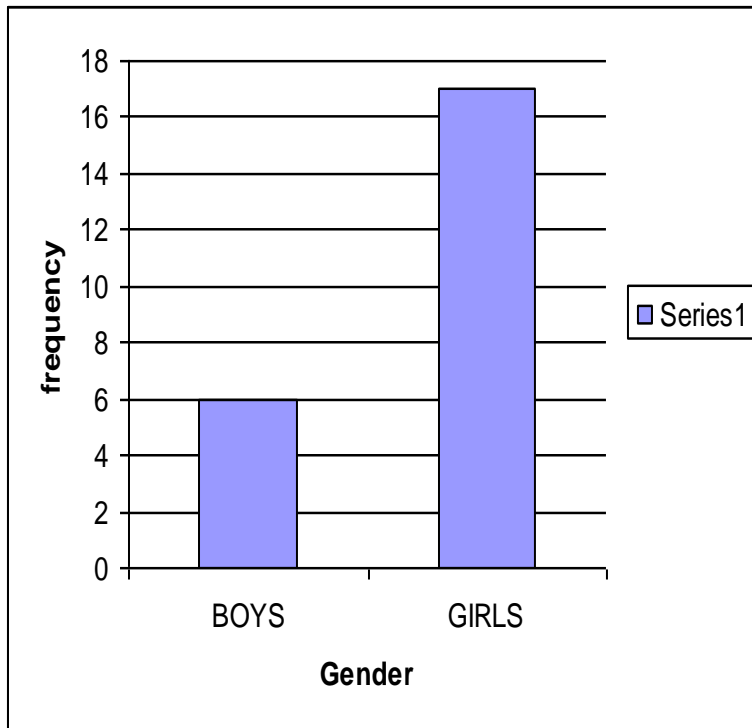
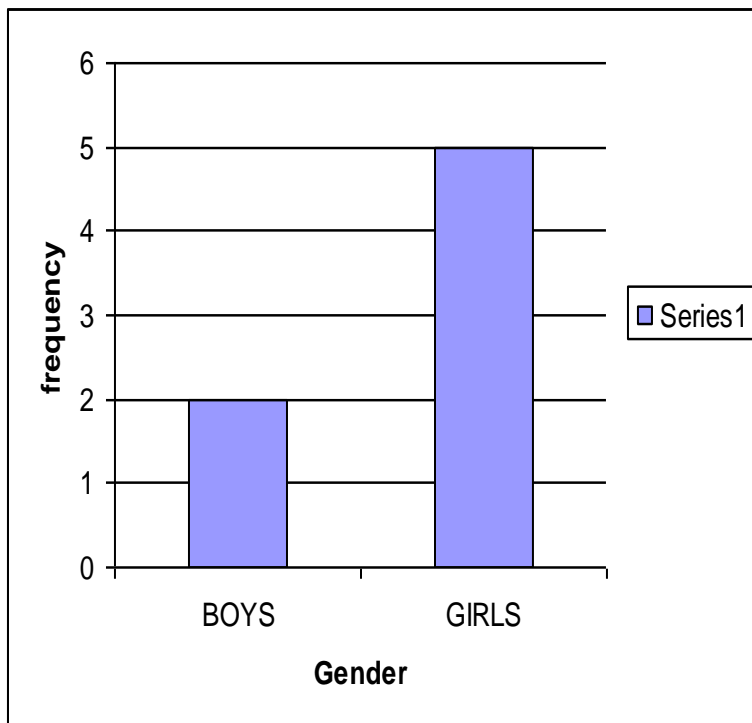


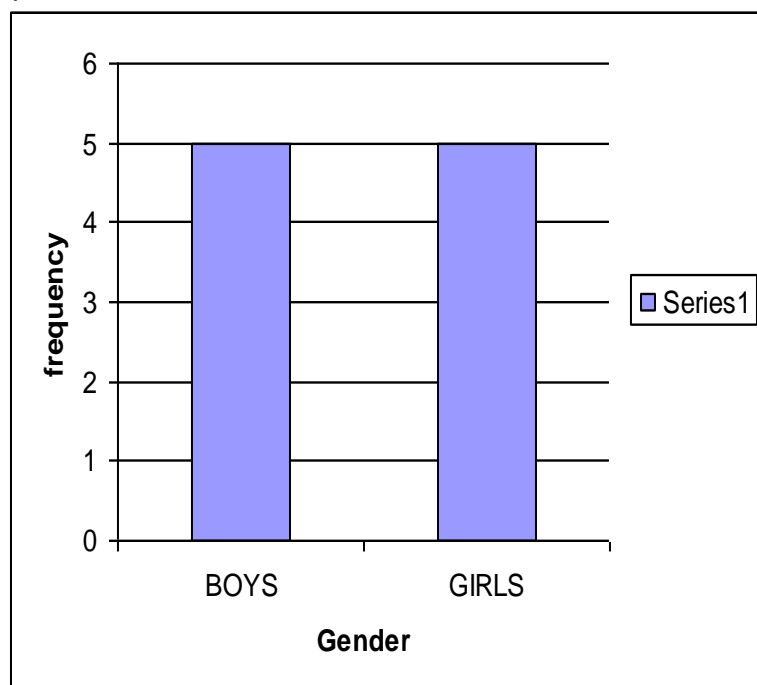
Figure 7 Showing the frequency of a male teacher choosing girls and boys to answer questions in class for school H.



5.5.5 Equal participation by male and female students in School D.

Both male and female students were provided with equal opportunity to participate in mathematics learning. Girls and boys equally dominated discussions and took turns to speak. Female students were afforded the same chance to show their grasp or lack of, of concepts. They freely moved forward to work out problems at the chalkboard and none of the other students made disparaging comments. It was clear that this respectful behavior came from the way the teacher perpetually interacted with the learners.

Figure 8 showing the frequency of a male teacher choosing girls and boys to answer questions in class for school D



5.5.6 Approaches used for learning that favor boys in Schools A, B, E, and F

It was observed that most activities that were used by teachers were competitive which tended to favor boys over girls. The methods which were used included lecture method, combined with question and answer technique, activities and presentations which were done orally. All these activities required immediate answers and individual exercises.

In these classes in the listed schools there was over-reliance on competitive approaches that adhered to the old practices, about gender differences in which male students benefited more than female students. This created an unfriendly environment for female students. The activities which were more predominant were those activities which allowed competition rather than the collaborative ones which encouraged group work.

5.5.7 Approaches used for learning that favor girls in Schools C, D, G, and H

In these schools, teachers relied on a mix of instructional methods which, as literature has indicated suits both groups of learners. Female students seemed to thrive in this

environment which did not rely on competitive learning method only. This seemed to promote females' self-esteem and motivated them. It was evident that females did not only prefer a more collaborative, less competitive atmosphere in the classroom, but also achieved more.

5.5.8 Female and male students' interactions in Schools A, B, C, D, E, E, F, G, and H

In all these classes in the listed schools boys dominated classroom activities and some of them displayed overtly masculine behavior that was also attention seeking. The other students seemed to admire while the teachers did not make any attempt to address this potentially disruptive behavior. There were girls who were more active than many boys but even these did not display the high energy levels of the boys. Neither did they take over the class space nor alienate boys.

5.5.9 Gendered seating arrangement in Schools A, B, C, D, E, E, F, G, and H

Generally in all schools, teachers were in control of the classroom space. Students were often given a space where to sit. Sometimes the boys were made to sit together with girls occupying another part of the classroom. Other times saw boys and girls clustered randomly without any directive from the teacher. At other times, boys and girls were made to sit next to each other in what appeared to be an attempt to neutralize the exuberant and disruptive behavior of some boys. The Boys were positioned as being active and mischievous while girls were seen as calm.

5.5.9.1 A Cluster seating arrangement in School A, B, D, E, F and H

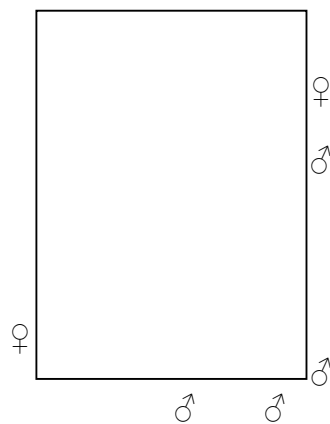
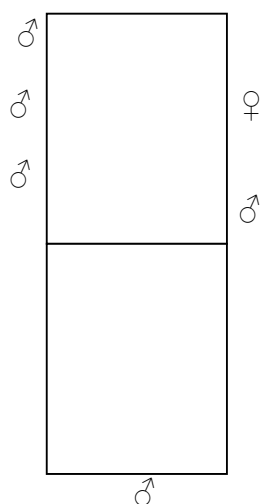
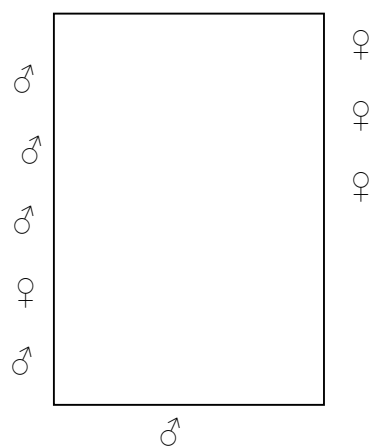
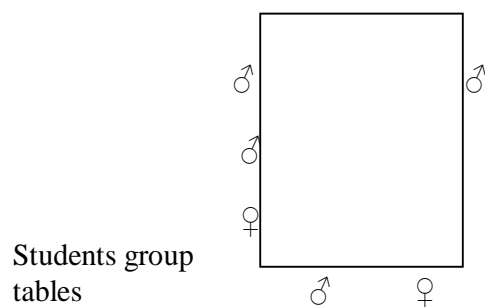
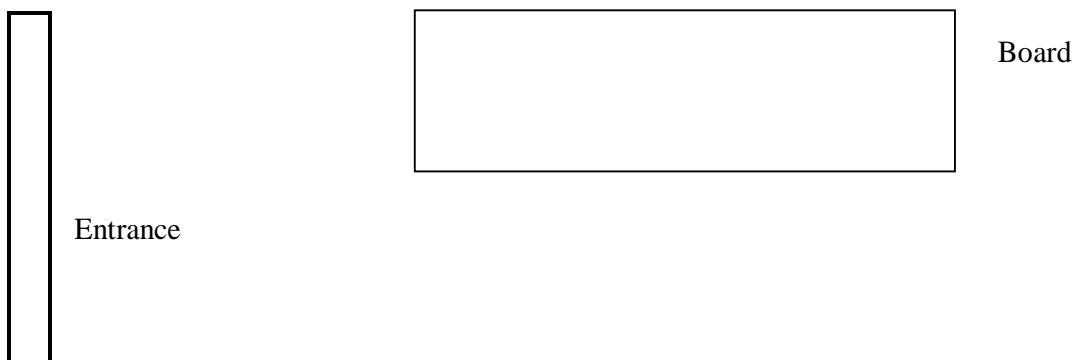
These classes in the listed schools had cluster seating arrangement and the disadvantage was the teachers' inability to maintain eye contact with all students when giving direct instructional lessons. Discipline problems arose because of some students' feeling that they were part of a small group: instead of a whole class. School C had a row seating arrangement and school G had a combination of row and cluster positions.

The teachers and students in these two schools, unlike in the majority of schools had a clear view of each other. Classroom control, discipline, and learning were more effective. Teachers had eye contact and effective communication with all students. It was evident that making students go into groups took most of the instructional time, which can perhaps explain why most of the classes in other schools did not organize group work learning, even though the advantages clearly outweigh the disadvantages particularly in promoting girls' learning.

The classrooms seating plans for the schools A to H presented below the show seating arrangement. The seating arrangements in most of the schools as indicated above did not facilitate good instructional communication, thus presenting discipline and control challenges. In such a set up boys tend to be dominant, disruptive worth some bullying of girls. They suffer disadvantage with some negative implications for their performance in mathematics.

5.6 CLASSROOM PLANS:

CLASSROOM PLAN FOR SCHOOL A

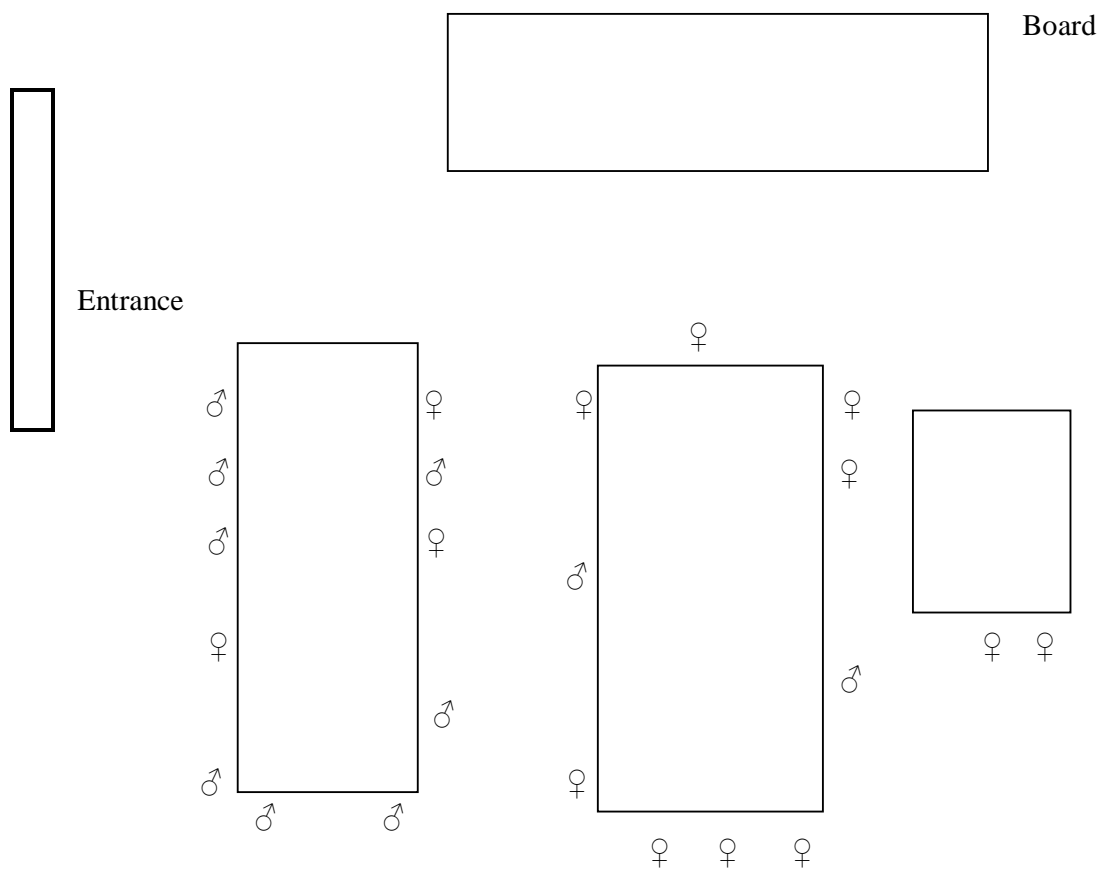


Key

♂ - male

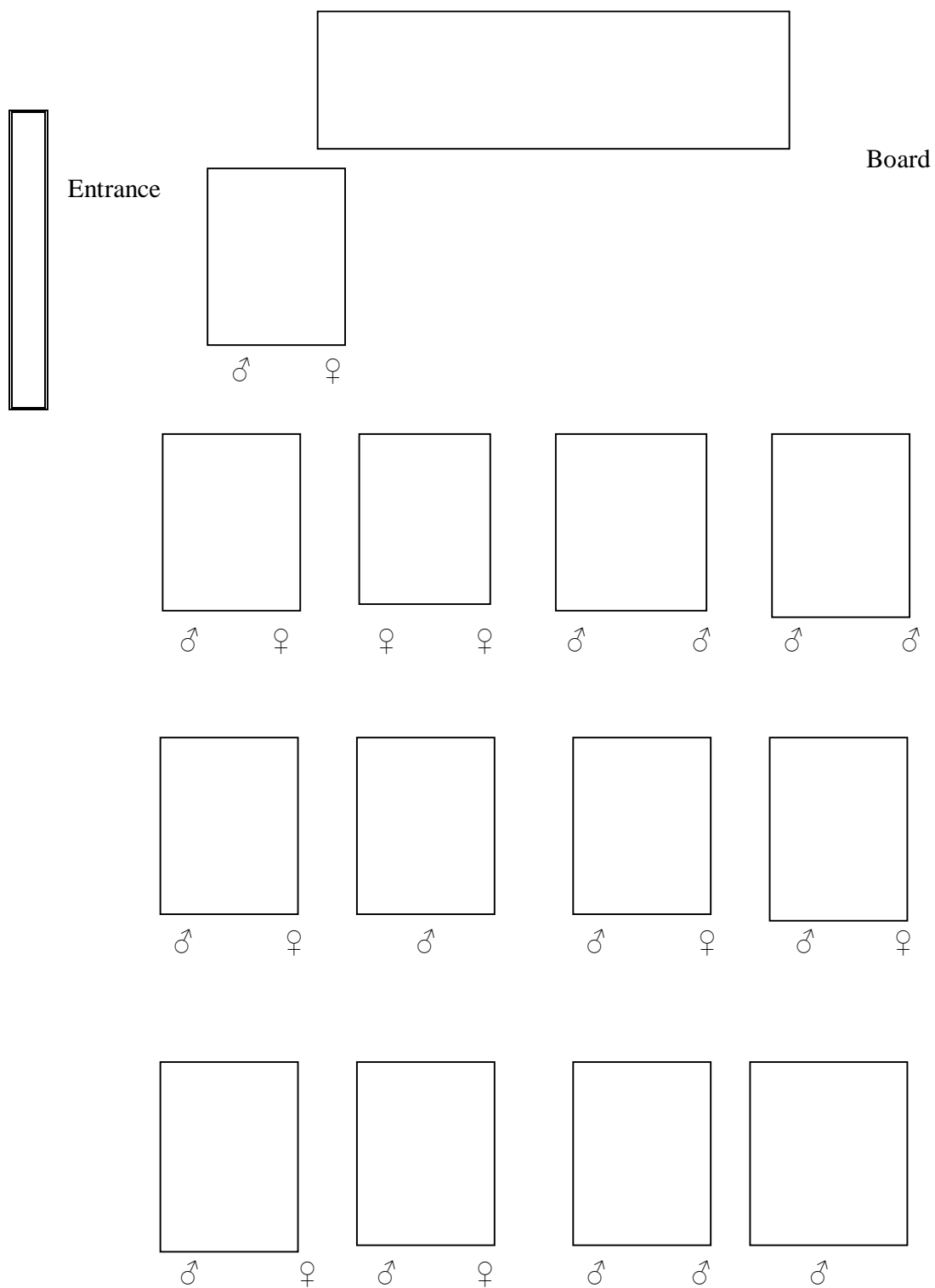
♀ - female

CLASSROOM PLAN FOR SCHOOL B



Key
 ♂ - male
 ♀ - female

CLASSROOM PLAN FOR SCHOOL C

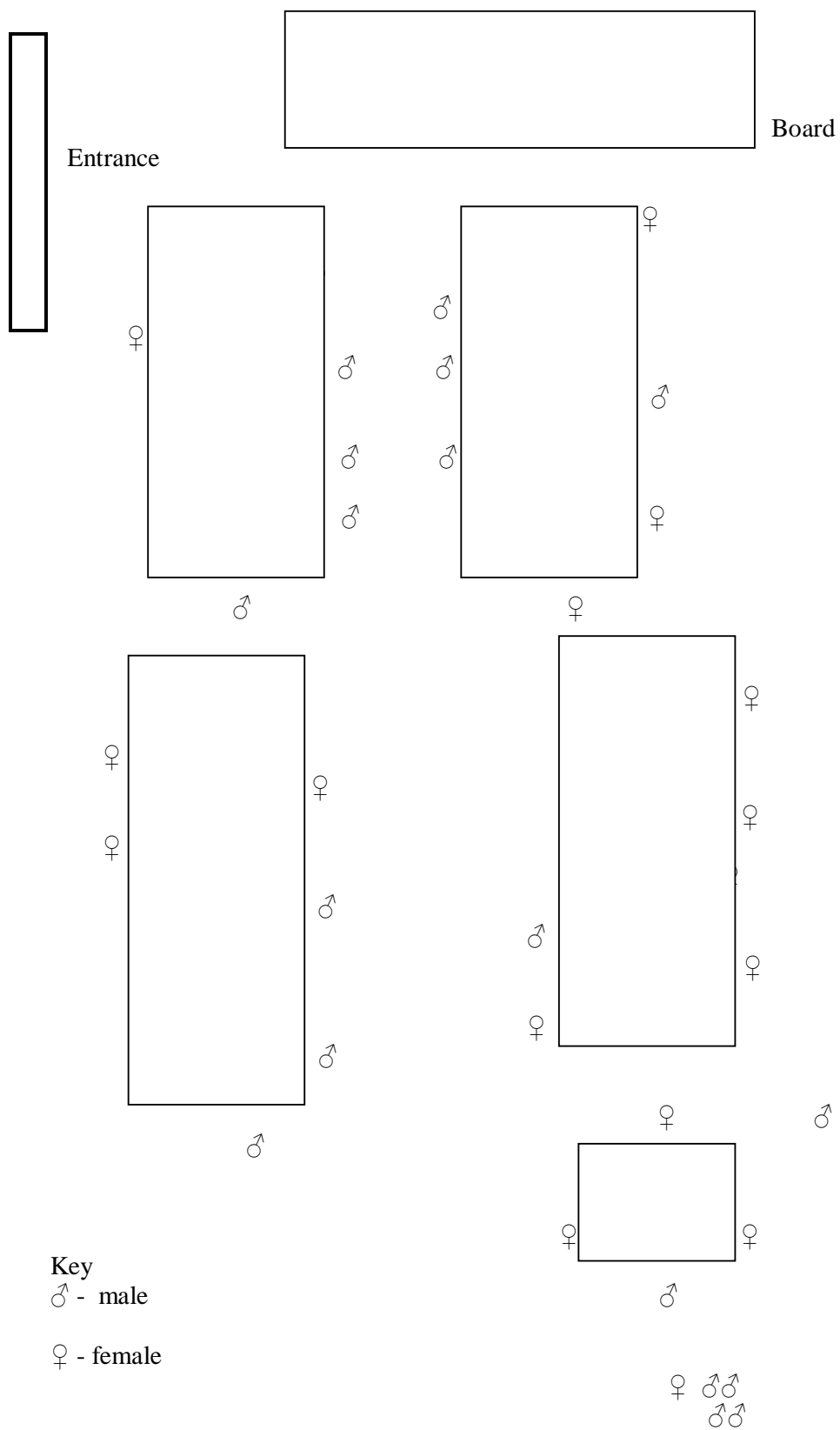


Key

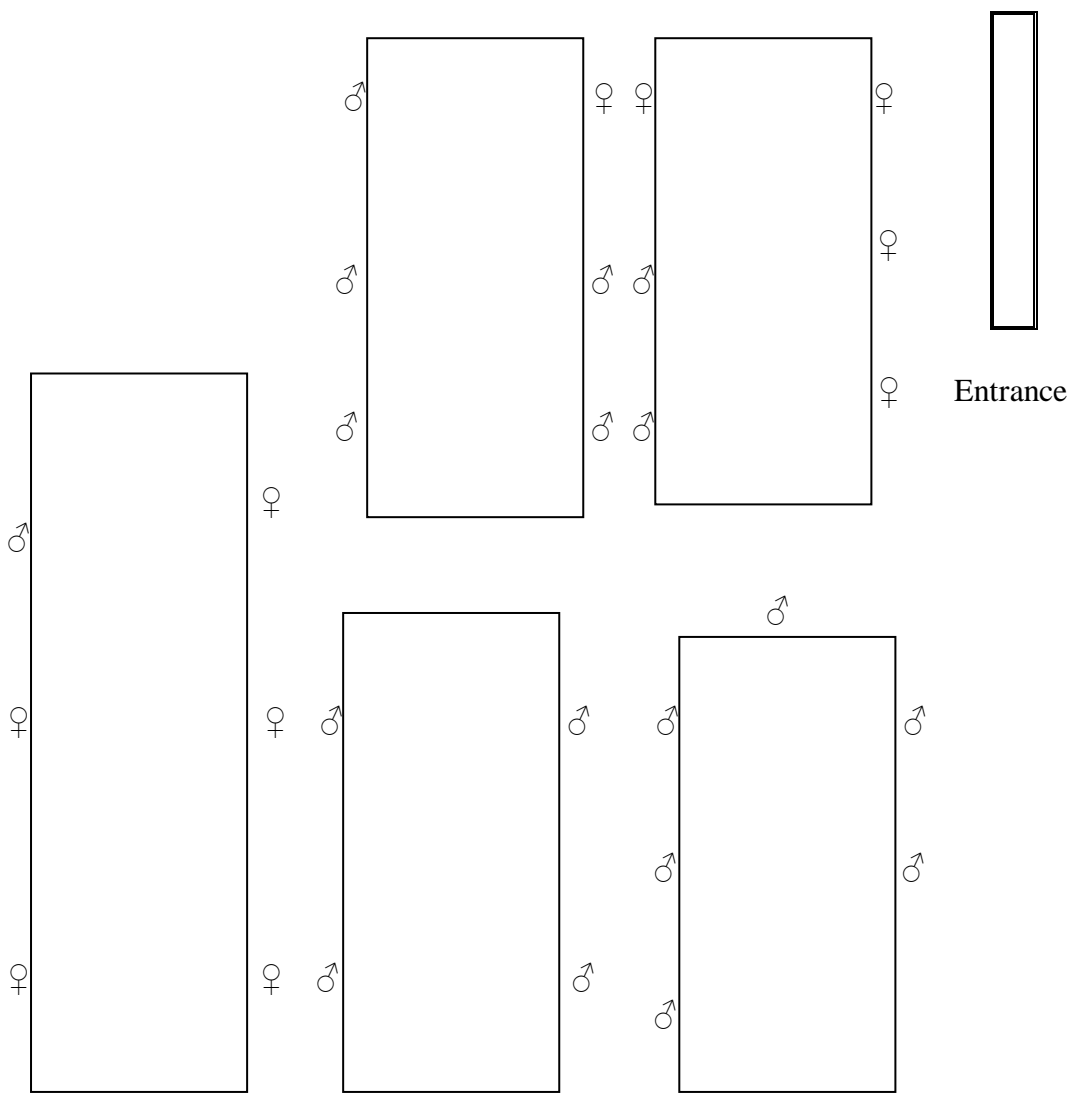
♂ - male

♀ - female

CLASSROOM PLAN FOR SCHOOL D



CLASSROOM PLAN FOR SCHOOL E

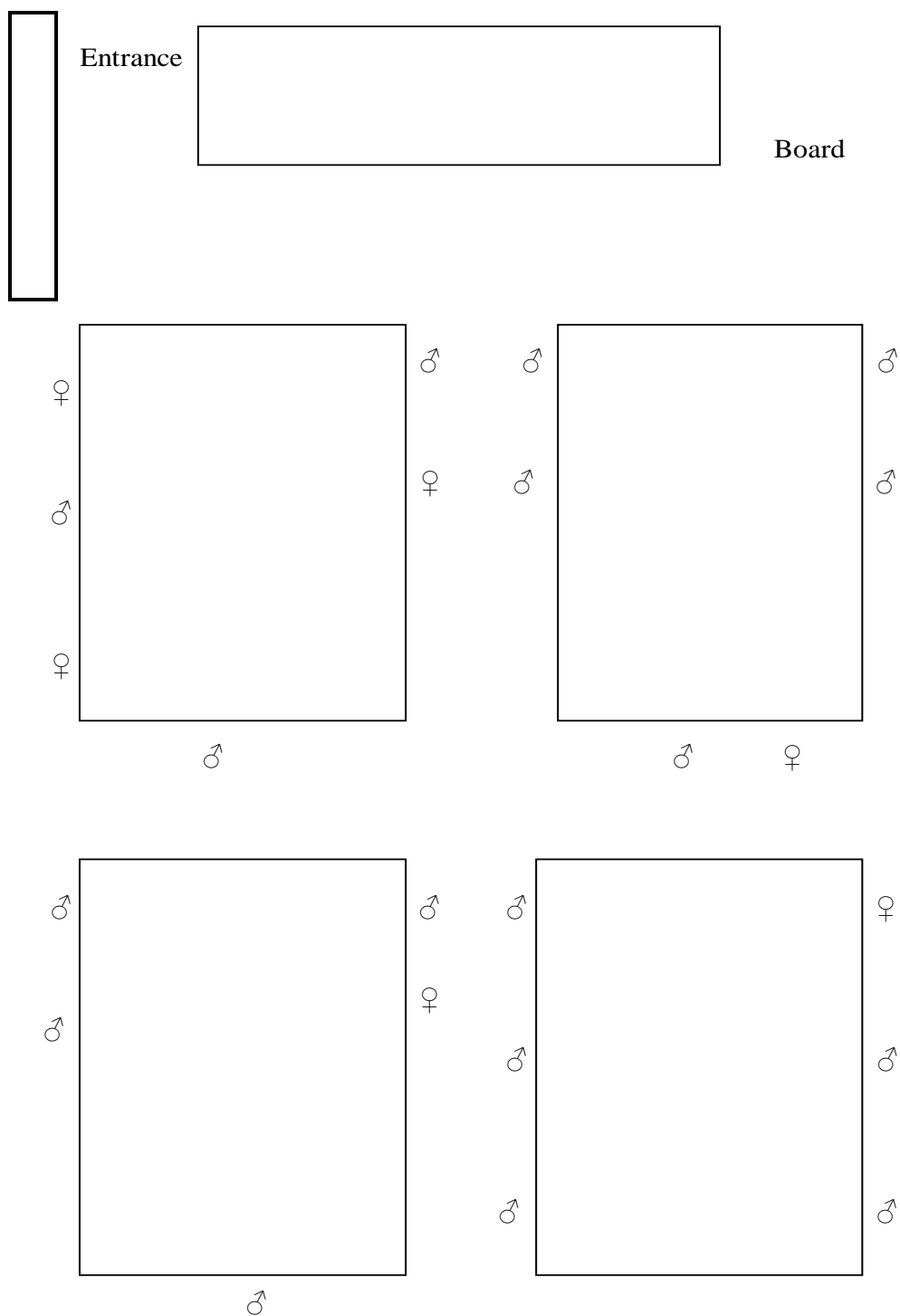


Key

♂ - male

♀ - female

CLASSROOM PLAN FOR SCHOOL F



Key

♂ - male

♀ - female

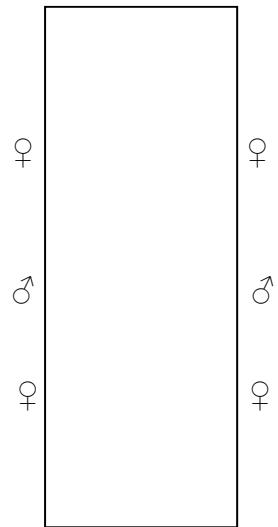
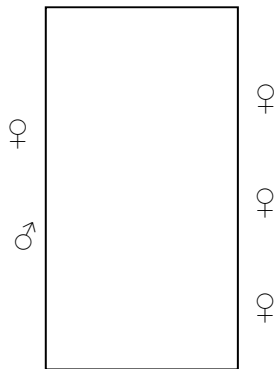
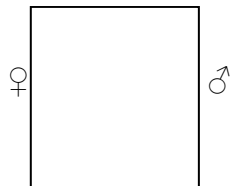
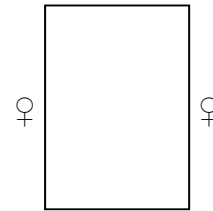
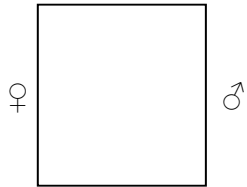
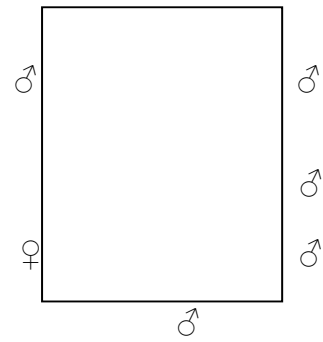
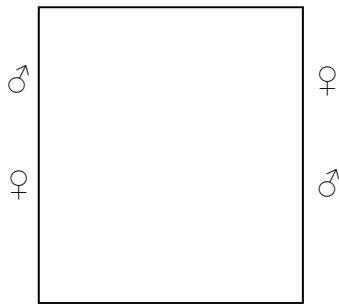
CLASSROOM PLAN FOR SCHOOL G



Board



Entrance



Key

♂ - male

♀ - female

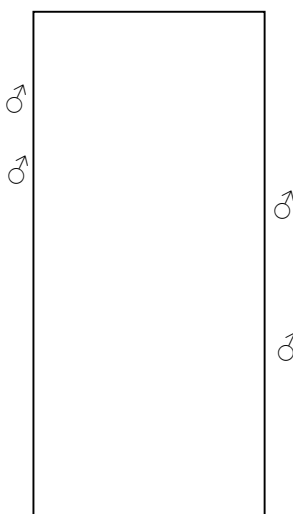
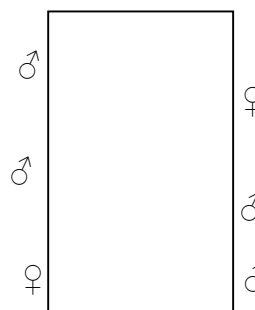
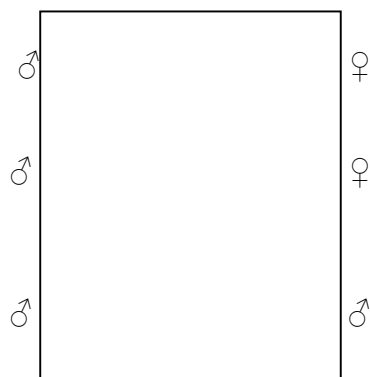
CLASSROOM PLAN FOR SCHOOL H



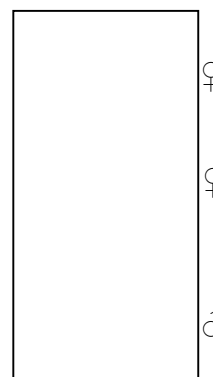
Board



Entrance



♀



Key

♂ - male

♀ - female

5.7 ETHICAL CONSIDERATIONS

The theory of ethics that informs this study is based on core and research ethics principle which are:

5.7.1. **Justice**

The schools, teachers and learners who participated in the study (which was done in the form of Digital versatile Discs (DVD's) should benefit from the knowledge generated herein before those who did not participate.

5.7.2 **Respect for persons**

Digital versatile Discs (DVD's) shall be treated with confidentiality.

5.7.3 **Beneficence**

The researcher must disseminate findings and recommendations to schools that participated in the production of these recorded lessons, in order for them to benefit from this study as the study will be insignificant if its findings are not disseminated.

5.7.4 **Anonymity and confidentiality**

Anonymity will be achieved by ensuring that research findings do not in anywhere expose school, individuals, ethnic group or nationality to public scrutiny and embarrassment. Confidentiality will be achieved by not revealing the names of participants who were seen in Digital versatile Discs (DVD's).

CHAPTER 6: ANALYSIS OF RESULTS

6.1 INTERPRETATION OF RESULTS

6.1.1 Teachers' differential interactions with students

The findings of the study lend support to the proposition that boys and girls have different experiences in mathematics classrooms and that teachers consciously or unconsciously create different interactions between boys on one hand and girls on the other. These findings were consistent with those reported in the literature by (Falco, 1996; Gipps, 1996) on the gender inequality theory, which is the theoretical framework which informed this research. They emphasized the unequal treatment of boys and girls in educational institutions resulting in denying one of the groups what the other one is granted. Significant inequalities remained due to unequal treatment of male and female students in mathematics classrooms. This required a fresh evaluation of the learning experiences of female and male students to be carried in schools.

Educational practices have traditionally had the achievement of boys as their main concern. This has led to education stereotyping mathematics as a male domain. This extends to the home as this unequal treatment of sons and daughters is seen through parents unconsciously or consciously failing to support their daughters' interest in mathematics. Parents do this by either by directing their interest elsewhere. Neither are the girls, presented with women who have been successful in mathematics careers who will inspire female students and be the people who they could look up to in order for them to reach higher levels and eventually end up in prestigious careers involving mathematics.

6.1.2 Gender dynamics in mathematics learning

Findings indicated that there were some gender dynamics in mathematics learning which were summarized as stereotype activation by teachers, compliance for girls and independence for boys. These results were consistent with those previously reported in the literature (e.g. Chipeta, Mazile & Shumba, 2000; The Botswana Revised Policy on Education, 1994; Bosow, 1986; Klein, 1985; Sadker & Sadker, 1982; Oakes, 1990; Garegae, 2006; Gipps & Murphy, 1996 ; Montgomery & Collette, 2006;).

It is clear that the preparation for life in society on the basis of whether they are female or male has been given more support especially in schools. This is because classrooms are miniature representation of the society and hence depicting faithfully in a similar way benefits and unfavorable outcomes. This shows that the gender ordering in society has been operating in classrooms (Marshall, 1997).

Irrational preference to a particular gender in learning is deeply rooted and this is evident in lessons and in teacher interactions with students, and amongst students themselves. This is part of the informal curriculum, which is taught based on the everyday operation of the school. Clearly this roles assigned to individuals on the basis of gender, in education is not deemed to portray equity for both boys and girls.

Socialization within the classroom setting often reinforced gender differences in society. This socialization process began as early as infancy and preschool, where students were taught to behave like 'nice little girls, and little boys', which often taught girl students to be passive, submissive and less competitive. In contrast, the socialization process taught boys to be assertive and competitive, more often with little regard to others and to females. This differential socialization affected the way students learned in schools. (Bellantine and Spade, 2004). Continuing differential treatment of boys and girls resulted in boys being more likely than girls to perceive themselves competent in mathematics.

Clearly it can be seen that femininity depended on distinction from being masculine or being feminine. Girls for example might know that they should be elegant courteous and hence show a great regard for others and hence should not show any form of aggression or any forceful behavior. They are advised to wait for their turn and not to disturb during discussions. This resulted in girls complying with the wishes or judgment of boys who were allowed to behave in a different way when compared to girls. Boys and other girls are always to sanction any out of line behavior by female learners. The widespread conceived notion of what it means to be male or female affects the behaviors of boys and girls as learners.

6.1 3 Teaching and learning approaches favoring males

The way teachers interacted with students was more inclined to boys than girls. This was evident as teachers praised, criticized and corrected boys than girls. Teachers particularly listened to the remarks uttered by boys, but girls were made aware that the behavior was inappropriate. Teachers called on male students most of the time, looked at male students to answer questions before females and gave more learning materials to boys than girls. Furthermore the boys used a variety of behaviors to ensure their unequal share and dominance of educational resources. This was in agreement with findings by Hayes and Flannery (2000); Eccles (1992); Kelly (1988); Gould (1995); Hendric and Stange (1989).

These authors have shown that gender inequalities existed in mathematics classrooms and attributed this to teacher perceptions about boys and girls. They wrangled the consequence of this actions was that boys benefit more than girls. These studies also confirmed that generally there is evidence that boys continued to predominate classrooms during discussions. This has resulted in the empowerment of boys for the world of work. Hayes and Flannery further asserted that two critical factors that influence students' decisions to pursue mathematics training beyond schools appear to be their interaction with the teacher and the encouragement from their parents.

Most classrooms that were studied were more often advantageous to male than to female students learning. Generally the observed trend was teachers' utilization of whole class lectures and the use of competitive reward structures. This teaching style favored boys. The findings from this study was supported by literature previously stated (Skelton et al, 2006; Peterson & Fennema, 1985; Fennema & Peterson, 1986; Hanna,

1996) that education played a central role in perpetuating inequalities and that classroom organization and pedagogic practice affected boys and girls differently.

6.1.4 Teaching and learning approaches favoring females

Where collaborative and team work were incorporated during competitive task in classes C, G, D and H girls' were favored by this teaching style. Also where the girls' were dominant in groups they were able to participate and share ideas. This was in agreement with previously reported literature by Sander (1982); AAUW (1992); Burke (1985); Fennema and Leder (1990); Ong (1981); Hopp (1994); Petterson and Fennema (1985); Fennema and Peterson (1986); Vrygotsky (1978) that women preferred a more collaborative, less competitive atmosphere in the classroom and achieved more in that milieu. This is also supported by (Murphy and Gibbs, 1996; Lee & Bailey, 2002; Winfred 1993) who argued that girls' learned better in a single sex schools', since this would sensitize young females' of their potential in an atmosphere free from pressures by the opposite sex.

6.1.5 Interactions between male and female students

Generally boys and girls were not seen to be working together in mathematics lessons. Interactions were gendered, that is groups of male or female students worked together, with boys clearly the more powerful group. This supports the findings by Hendrick and Stange (1989); Skelton, Francis and Smulyan (2003).

They built up their argument as they gave examples, in which boys in a small group behaved differently than boys alone and boys were stimulated by challenges presented by other boys. Also those, boys in a small group were likely to receive help from girls when they asked, but that girls' requests were ignored. Gender had an impact on classroom interaction. Girls and boys sat apart, except on the condition when they were organized together by the teacher. The students also formed friendships within their own sex groups even though there were exceptions.

It was confirmed that girls and boys in a group were seen to behave in a different way. It is important to take note of the fact that not all girls or boys behave in a conventional way. It was generally observed that children of the same gender tended to crowd in a particular space in class and this resulted in different behaviors being observed. This could be attributed to the fact that teachers would use girls and boys as descriptive terms to depict groups and the way interactions are to be in the classrooms. This further separated and made the distinctions between the female and male students to be more prominent. This was supported by Bailey (2002).

Primarily, classrooms which showed a separation between males and females behaviors, that seemed to support the informal curriculum within the society. This could make the girls to believe that boys were more significant than the girls. The impression that the boys dominated the space in the classroom and also received special treatment. This practice did not deviate from the everyday practices that we observe in our society. Girls who behaved differently were criticized or disapproved of their behavior. The issue of whether someone is male or female is vital since it impacts on

the pupils educational and the behavior that depicts the interaction of persons in a group. The outcome is that this has unpleasant results for their future and how their life will be ultimately shaped.

6.1.6 Gendered seating arrangements

The seating arrangement was generally segregated as there were sex differentiated groups with more males and few females, or more females and a small number of males. Traynor (2003) confirmed that classrooms were spaces where teachers were able to control bodies in a gendered and sexualized way; that teachers retained total control during a lesson, giving learners little chance to make own decisions about where to be seated. Thus learners were unable to exercise autonomy over class arrangements. These highly structured arrangements gave rise to stereotypical and gendered notions about dominance, leadership and independence, as teachers continued the tradition of consciously or unconsciously bestowing these attributed on boys.

6.1.7 Gendered seating arrangement in the African context

The way the society brings up boys and girls results in learners in schools assured that girls are made to believe that they are not equal to boys. This is evident even in the seating arrangement as students are usually seated according to gender. Teachers also ratify in their actions that boys and girls should be treated differently. There was also proof to support that despite girls having shown to be more successful than girls academically, the classroom still portrayed actions which worked against equity. This is primarily because teachers socialized girls in the same old practice, of what it implies to be female. This gave a clear message ultimately that mathematics was unfeminine and was not for girls.

6.2 QUESTIONS ABOUT ALTERNATIVE APPROACHES

Although there have been many studies on the differential performance of girls and boys in mathematics, very little research has focused on how the day to day learning environment differs for them. Much of what we are familiar with concerning gender and mathematics has been deduced from research methodologies influenced by the positivists perspective, that have focused on observable behaviors which included looking at answers given in a test, the item analysis, the career decisions that student make and lastly the interactions between students and teachers.

While this positivist methodology of the studies yielded efficient and valuable information on gender and mathematics. I will argue that until and unless such studies were supplemented with other learned creations that use other alternative methodological perspective. I believe that feminist research methodology will continue to furnish eminent and notable understanding of this complex situation around gender and mathematics. While the positivist perspective emphasized the irrelevance of male-female differences, feminists emphasized that studying and understanding such differences was critical in the dynamics of the learning of mathematics.

The feminist perspectives provided access to alternative discourses that helped understand how identities were shaped and meanings and truths constructed (Murphy & Gipps, 1996). While Murphy & Gipps (1996) thought older positivistic studies were helpful, I believe that interview and observation methods and techniques used by feminists have brought out deeper insights in the area of gender and mathematics learning.

6.3 STRENGTHS AND WEAKNESSES

Pre-recorded digital versatile discs (DVD's) were used which portrayed mathematics teaching and learning activities in each of the eight selected schools from the two districts which were Kgatleng and South East. The data which was in the form of (DVD's) was obtained from Human Science Research Council (HSRC) - Stanford University - University of Botswana Regional Education Study. The advantage of using the recorded lessons was that the lessons could be reviewed over and over again, during analysis. In addition the lessons were recorded by experts who made quality digital versatile discs (DVD's).

The verisimilitude of the footage or how true to life is the recordings maybe an issue. It should be noted that with the use of digital versatile discs (DVD's), having a typical lesson was difficult because of the possibility that the teachers and students staged for the camera.

Some of the important behaviors that constituted gender dynamics may have been missed out because teachers and students knew they were being recorded. It was necessary to do several recordings to get the genuine behavior from teachers and students. Additionally the eight schools selected were from the two districts of Kgatleng and South East. While raising important gender and education issues, the findings may not strictly be generalized to the whole country.

An instrument in the form of checklist was used and this also required a gender audit. A checklist indicated whether something was there or not. This required a gender audit of the mathematics classroom environment to be done. The following checklists were used: gender bias, seeing gender; classroom audit; seeing gender; classroom observation protocol (appendix A, B, and C).

This study only involved coeducation schools where males and females learned together at the same time. This was the only type of instruction in Botswana, since we do not have single sex schools where males or females are learning alone. A set up of males or female learning alone would provide information of value since this would be used for comparative purposes and hence build on the body of knowledge and largely on research.

CHAPTER 7: CONCLUSION

7.1 GENERAL DISCUSSION

This study, its purpose was to establish the extent to which gender dynamics in mathematics learning impacted on students' performance, looking at what actually happens in the mathematics classrooms. The findings of the study lend support to the earlier study findings about gender relations in the home and community and these practices were mirrored in the classroom and mathematics learning.

Gender and mathematics issues focused on the context of teachers' differential interactions with the students; gender dynamics in learning; approaches used for learning and teaching which favor boys or girls; interactions between female and male students and gendered seating arrangements and its significance in the African context. All of these provided differential processes and outcomes for girls and boys, existed in mathematics classrooms. Girls and boys received separate and unequal educations due to the gendered nature of schools and the sexist hidden curriculum.

This study has revealed that both the classrooms and the teachers themselves reinforced gender stereotypes portraying mathematics as a male domain. The teachers, who were also victims of gendered socialization, have been brought up to believe from an early age that gender differentials are God-given. As a result they were often oblivious or simply found to be accepting of gender inequalities.

Teachers generally interacted more with male students than female students. This was evident as teachers frequently called on male students to answer questions in class. While male students in the classroom received most of the attention, females were to a large extent be referred to as, what could be called passive spectators. As a result male students benefited from mathematics teaching than their female counterparts.

Generally there was utilization of whole class lectures as the dominant teaching strategy and this favored boys but was detrimental to females learning, who were favored by cooperative and team work. Three male teachers in schools C, G, and H and a female one in school D used this cooperative approach hence competition was minimal amongst students.

Generally biases were persistent as teachers would interact differently with groups of students depending on their gender except one teacher who responded equally to both female and male students in school D. This implies that boys and girls are likely to show preferences, which would appear different in terms of their learning styles. There is need to ensure that these established methods are flexible. In addition teachers should be gender sensitive in their choice of teaching methods.

Interactions of male and female students in mathematics learning were seen to be gendered as students were comfortable working with the same gender as theirs. Leadership roles were unequally distributed; the same applied over distribution of learning materials. It was evident that female students were mere spectators most of the time. Interruptions were generally made by male students when girls spoke.

The seating arrangement was mostly cluster followed by rows and columns and combination of rows and columns. It was evident groups were segregated. This was because male students outnumbered female students in most classes. Also teachers' movements were restricted in the front of the class, limiting overall class communication. Up until teachers are informed and well equipped with knowledge on the effects of making females and males to behave differently in order to conform to the image of an ideal male or female. Such irrational preferential messages, that teachers send every day, with no intention of harming the students have been found to contribute to girls not receiving equal education as their male counterparts.

“Unless, all forms of discrimination, on the basis of whether they are female or male in educational institutions are obliterated, then the majority of students will be swindled and their talent and ability not recovered in society”. (Sadker, 1994).

When looking at the significance of gendered seating arrangement in the African context, it could be said that culture had a major role to play. Teachers usually use their powers to try and control troublesome males by making them sit next to females to try and control their behavior. Here, it could be said the teacher uses female students to ensure correct behavior. But since, both the female and male students, the teacher being inclusive have been socialized in a patriarchal society, which is characterized by male domination; this tends to be mirrored even in the classroom. This is because the classroom is a small representation of society. In the African context a classroom is like a cage where students experience barriers which tends to distance them from each other and the teacher, this usually brings distrust, denial, delay and interruptions.

Co-educational schools have contributed to substantially different outcomes for male and female students. The time has come for policy making to explore alternatives to this format of schooling. There is clear evidence that coeducational schools play a major role in reproducing dominant ideologies which only serve to maintain the status quo in formal education.

7.2 SUMMARY

This Thesis combined gender and classroom interaction to analyze gender inequalities in mathematics classrooms. This study focused in gender dynamics by actually looking at what actually happens in the classroom, with focus to Botswana 6th grade students. This study used pre-recorded Digital Versatile Discs (DVD's), from Kgatleng and South east district which portrayed mathematics teaching and learning activities. All the six research questions were answered.

The feminist research methodology, which its emphasis is to study women and also seeks to put women's voices and experiences at the center of its discourse was used. The methodology is aligned with the transformative paradigm which seeks to liberate and change societies. The credibility of the study was enhanced by the using the triangulation method for easy presentation of results. Gender dynamics impacted on students' performance. The gender dynamics in mathematics teaching and learning were grouped according to emerging themes which are presented as a summary below.

Fig 9 Summary of Results using data coding : emerging themes

Emerging themes	SCHOOLS							
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>
1.Stereotype activation by teachers	•	•			•	•	•	
2.Teacher's interaction with males than female students	•	•			•	•		
3.Teacher's interaction with female than males students equal				•				
4.Approaches used for learning that favor girls			•				•	•
5.Approaches used for learning that favor boys	•	•			•	•		
6.Gendered interactions of male and female students	•	•	•	•	•	•	•	•
7. Domination of classroom interaction by male students	•	•			•	•		
8.Domination of classroom interaction by female students			•				•	•
9.Gendered seating arrangement	•	•	•	•	•	•	•	•
Cluster seating arrangement	•	•		•	•	•		•

7.3 RECOMMENDATIONS FOR FUTURE RESEARCH

Drawing on observations of classroom interactions in primary schools, the following recommendations were made on how gender dynamics in mathematics learning could be addressed.

- The different departments of Education, being Pre-primary, Primary, Junior secondary, Senior secondary and Tertiary education should provide compulsory modules on gender equity to all teachers. This will sensitize teachers on gender issues.
- Policy makers in the education sector should introduce a gender sensitive education policy and practice. This would mean having qualified gender officers in all government and Non-Governmental organization who are knowledgeable on issues of gender.
- The Ministry of Education should introduce single sex schools to encourage both males and females to do well in mathematics as both sexes are not comfortable with each other's practices in class.
- The Ministry of Education should make the course "introduction to gender" to be a compulsory in all teacher training institutions in order to prepare teachers, and to shift them from the gender socialization that they had to undergo through during their years of schooling.
- The Ministry of Education to review teacher student ratio in order to allow different seating arrangements that would allow teachers and students to explore different learning styles.
- Policy makers and other stakeholders should encourage an effective and realistic policy to integrate gender into all public policies and programs
- Schools to have teacher led, classroom discussion and activities to explore issues of social exclusion. The teacher as a change agent should guide the different scenarios of social exclusion, with students collecting evidence as active stakeholders.
- Ministry of Education should develop and implement a mandatory in-service teacher training to provide training on the ideological basis of the social institutions that entrench gender inequalities and other forms of social exclusion.

In the light of improving participation rates for girls in mathematics, these implications focus on problems within the curriculum which are the most crucial in the gender equity issue in schools.

- Having females and males showing difference in what they prefer as their learning styles and methods. This implies that teachers must then adapt to their students learning by choosing the right methods of teaching to fit their students.

- The consequences of these 'learnt preferences' for learning in mathematics classrooms are exemplified throughout this research. Accepting and being aware of practices that perpetuate these inequalities actually trying to work in that direction to overcome them can actually help to build both females and males to be good listeners as well as exceptionally effective speakers.
- This would also mean paying particular attention to how gender dynamics in mathematics classrooms can benefit students in the subject and bring about positive outcomes in the academic performance. To elaborate on that further, as an example the unequal participation of students can be improved without actually upsetting or affecting the quality of content delivery provided.
- This would imply that, rather than seeing gendered classroom interactions as inevitable. It is important that teachers and educators do what they can to address and challenge such behavior. A simple starting point may be to reflect on teachers classroom practice, asking whether the teachers condone or perpetuate gendered behavior which disadvantages some of our pupils.
- This calls for more research to be done in the area of gender dynamics in mathematics learning basically looking at classroom interactions, this need to include gender of the teacher, ethnicity, and race and socio economic class in order to determine which groups the knowledge is accessible or valuable for. These social variables cannot be ignored, because they are intertwined with gender, thus showing the inadequacy of any explanation that generalizes about 'the girls' or 'the boys'.

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APPENDIX A: GENDER BIAS AUDIT OF THE CLASSROOM

CLASSROOM ARRANGEMENT

- Who sits where and why?
- When students work in groups, how are the groups determined and why? Are there sex segregated groups?
- Are boys doing more “doing” and girls doing more “watching”?

CLASSROOM MANAGEMENT

- Carefully examine rules and methods. What are the biggest behavior problems? Are the problem behaviors more common among boys or girls? Do the rules apply in the same way for all students? Which students seem to be in trouble?

Adapted from Boston. Allyn & Bacon (1995).

APPENDIX B: A GENDER CLASSROOM AUDIT: SEE GENDER

The checklist was made with the intention to furnish, the acquisition knowledge from the classroom. This will be in terms of the teaching styles and the use of gender, in order to understand how to unify experiences.

	Poor	fair	good	excellent	N/A
In the classrooms:					
(a) The extent to which the way boys and girls are seated, allow them to have equal privilege to approach the teacher.					
(b) The extent to which leadership roles are distributed equally among male and female students during group work activities.					
(c) To what extent are male and female students allowed to have equal privilege to instruments that are used. Are the girls given an opportunity to use the instruments provided. Is it ensured that girls are active throughout the activity rather than being spectators, while boys are in control of everything					

(d) To what extent, do classrooms reflect female and male students working together to finish a task. This should demonstrate equal contributions of female and male contributions observed.					
(e) When looking at the classroom rules and management of the class, are the rules equally applicable to both boys and girls					
Evaluation:					
(a) Are similar comments given to both female and male learners for equitable work?					
(b)When making recommendations for improvement the same recommendations are given to female students as male students.					
(c) Is there conscientiousness of the criticism given, as to whom, for what and whether more criticism is given preferably to a particular group?					
The way interactions expressed are viewed:					
(a) Are things that are said to male and female students similar?					
(b) Is the informal discussions equally directed to male and female students equally?					
(c) When responding, are the needs and wants of female and male students equally attended to?					

The kind of reinforcement Here a report of what is said when a student gives an answer which is by responding to a question. Note if the comment is reluctantly in a neutral way, i.e. "okay". Or whether what is said is more optimistic like the use of "excellent", "very Good". Actually, it should be recorded as to who gets the reinforcement.		Teacher' movement in the room: It should be noted whether the teachers' movements are not restricted to a particular location in the classroom. Does the teacher attend to one group at a time in order to manage the class, thus affecting the learning process of others? The way the teacher moves should be recorded in each of the block in which any block should be ticked if the teacher spends 15-20 minutes in that certain location in class.		Correcting Behaviors One way of ensuring that classrooms have high standards of discipline is by calling names of students who misbehave. This looks at students who are inattentive either by sleeping. To keep a report of whether a male or a female student is called and hence make a clear pattern out the teacher should emerge.	
Female students	Male students	The front of the class	Female learners	Male learners	
		The middle of class			
		The back of class			
		Moving from back to front			
		Other comments:			

Adapted from [www.meac.org/.../ seeing gender/pdfs/classroomchecklist.pdf](http://www.meac.org/.../seeing%20gender/pdfs/classroomchecklist.pdf).

LIST OF FIGURES

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Figure 5 frequency of a male teacher choosing female and male students to respond to questions asked in class for school C.

Figure 6 frequency of a male teacher choosing female and male students to respond to questions asked in class for school G.

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Fig 9 Summary of findings using data coding : emerging themes

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Classroom plan for School C

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Classroom plan for School G

Classroom plan for School H