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AN ASSESSMENT OF THE GIRLCHILD PARTICIPATION IN SCIENCE SUBJECTS AT ADVANCED LEVEL WITH THE INTRODUCTION OF THE STEM INITIATIVE: A CASE STUDY OF GLEN VIEW SUBURB SCHOOLS.

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DEDICATIONS

I dedicate this project to my family for the big role that they played through their financial, spiritual and moral support since the first day of this academic journey.

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ABSTRACT

The development discourse has proved beyond doubt that there is no development that we can talk about if it is still discriminating or marginalizing some groups of the society especially women and the girl child. Because of this, this document seeks to assess and analyze the extent to which the girl child is participating in science subjects at advanced level in Zimbabwe concentrating on the period starting 2016 when the STEM Initiative was introduced as a measure to promote a science-based economy and industrialization. It looks into similar situations from other nations that have also implemented the STEM Initiative, and make comparisons and distinctions from them. Case studies of Glen View 1 High and Glen View 2 High Schools from Glen View-Mufakose District of Harare Metropolitan Province were used in the research. Data was collected, Causes of the disparities were uncovered through interviews, questionnaires and observations and at the end conclusions and recommendations were made. This was all done in a bid to try and expose barriers to complete girl child emancipation through science education as well as to put forward measures that will help to encourage them to participate in science subjects, a step towards gender equality and national development inclusive of the girl-child.

ACCRONYMS

ACRWC	African Charter on the Rights and Welfare of Children
A Level	Advanced Level
CAMFED	Campaign for Female Education
CEDAW	Convention on the Elimination of All forms of Discrimination Against Women
CSOs	Civil Society Organizations
GV 1	Glen View 1 High School
GV 2	Glen View 2 High School
HIV	Human Immune Virus
MBC	Mathematics, Biology and Chemistry
MOHTESTD	Ministry of Higher and Tertiary Education, Science and Technology Development
MOPSE	Ministry of Primary and Secondary Education
NGOs	Non-Governmental Organizations
OECD	Organization for Economic Co-operation and Development
O Level	Ordinary Level
SADC	Southern African Development Community
STEM	Science, Technology, Engineering and Mathematics
UNESCO	United Nations Educational, Scientific and Cultural Organization
ZIMDEF	Zimbabwe Manpower Development Fund

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CHAPTER ONE

Introduction.

While Zimbabwe is among the leading nations on the African continent when it comes to education and literacy rates, it appears that the country still has a lot to improve on especially to address the gender disparities that exist between males and females. To this end, this dissertation seeks to assess the extent of the girl-child's enrolment and participation in the 'traditionally male dominated' science subjects at Advanced level in two of Harare's high density suburb of Glen View in relation to the introduction of the STEM Initiative. The researcher seeks to establish the current enrolment patterns in regards to the gender inequalities that are existing between the boy-child and girl-child participation in science subjects at Advanced level. The causes of these disparities are also investigated in a bid to understand the root of the gender disparities in the uptake of science subjects in the country. It is the aim of this study to come up with informed solutions or recommendations that can assist to close the science uptake gender gap in secondary schools. This is in line with the various international gender conventions and protocols, including the African Charter on the Rights and Welfare of Children (ACRWC) which stresses the need to maintain both the boy and girl child's equal rights to education, without gender discrimination.

This chapter provides the background of the study, the conceptual Framework on which this research is based; the statement of the problem; the research questions and objectives; theoretical framework that backs the research; study limitations faced in carrying out the research, delimitations and research ethics.

Background of the study

Education in general, and specifically in the field of science and technology, is an indispensable prerequisite for technological and national development. In fact, globally, science and technology are considered to be the catalysts for economic development necessary for the improvement of the individual and community well-being (Scheibinger 2010). Not surprisingly, the Budapest Declaration 'underlines the importance of science education for all' (UNESCO 2010:9) However in Zimbabwe, since the declaration of education for all at independence in 1980, and the signing of various international gender protocols and conventions the science and technology side of education is still one of the areas where gender disparities abound. At Advanced level there is a low enrolment for girls especially in the area of mathematics and

science. This is against the background of an increased participation of female students at Ordinary level even in these science subjects. This could be the result of what has been noted by researchers that 'girls and women have less confidence in their abilities than man do and that from early adolescence, girls show less interest in mathematics and science subjects and carriers, (Halpern et al 2007:6).

While there has been concerted efforts towards achieving gender parity such as the vigorous campaigns for female education by Non-Governmental Organizations like CAMFED and government efforts, the achievements and completion rates have seemed to remain biased towards males in the field of sciences at Advanced level. Recently, the government has attempted to address this gender disparity by implementing the Science, Technology and Mathematics educational program to encourage not only boys but female students to take up these subjects in secondary schools of the country. It is in the context of this background of established gender disparities, government efforts against it as well as the global cry to empower women through education that this research aims at unearthing whether the situation has changed or not in as much as the extent of the girl-child's enrolment in science subjects at Advanced level is concerned.

Conceptual Framework

- STEM

STEM, which stands for science, technology, engineering and mathematics as postulated by the Zimbabwe Manpower Development Fund (ZIMDEF) (2016) is a government initiative that was born out of the vision enunciated by His Excellency, the President of Zimbabwe, R.G Mugabe when he said, "there is need to equip learners with knowledge and values that guarantee economic growth and increased opportunities for employment creation; well-rounded citizens who are relevant nationally and competitive globally." On 27 January 2017 the Ministry of Higher and Tertiary Education, Science and Technology Development, launched the 2016 A-Level STEM Initiative. The initiative seeks to encourage students who sat for their 'O' Level examinations in 2015 and obtained a Grade 'C' or better in Mathematics, Biology, Physics and Chemistry to take a combination of these STEM subjects, the Ministry will pay tuition fees and boarding fees at Government, Mission and Council Schools.

- Gender

It has been defined by Rubin (1975:165) as 'socially imposed division of sexes'. He went on to argue that it is an arrangement by which biological raw material of human sex and precreation is shaped by human social intervention: a process referred to as gender socialization where the roles, attitudes and behaviors of men and women are dictated. . Gender can also be understood as human traits linked by culture to each sex socialization (Haralambos and Holborn, 2004).Within a society; males are socialized to be masculine as females are taught to be feminine. Walter and Manion (1996) maintained that gender is the difference that sex makes within a society, guiding how we are to think of ourselves, how we interact with others, the social opportunities, occupations, family roles and prestige allowed males and females. It can also be defined as "a set of characteristics, roles and behavior patterns that distinguish women from men which are constructed socially and culturally and are not biological" (Gita Sen in Towards Earth Summit, 2002:1). This has been a concept that has been used to determine the development of states hence knowing this concept will help one to measure where our state is, concerning development along gender equality lines.

- Gender Equality

It is the view that everyone should receive equal treatment and not to be discriminated against, based on their gender. It is a situation where everyone has the right to equally participate in all aspects of life that are political, social, economic and cultural without being disadvantaged because of the fact that they are male or female. The concept will help one to understand that the importance of treating both boys and girls in an equal manner.

- Gender Gap

As will be used in the research, it is the difference between men and women as reflected in the social, political, intellectual, cultural and economic attainment, opportunities, or attitudes. The smaller the gap between boys and girl in science education, the more quick the process of girl child emancipation through education. Therefore, this concept will help me (the researcher) to determine whether there has been any improvement or not in as much as the enrolment and participation of the girl child is concerned.

- Development

It has been conceptualized by Owen and Shaw (1972) in terms of participation of the under-privileged person in institutions so that they can have control over the economic, social and political benefits that are at present monopolized by the elites, and from a gender perspective, by males. From this definition therefore, the equal participation and enrollment of the girl child in science subjects points to development in the education sector.

Statement of the Problem

Zimbabwe has enjoyed a great deal of progress when it comes to education, boasting of a literacy rate of 95% as estimated by the Demographic and Health Survey (2011) with UNESCO (2013) estimating it at 83,6%. However, the general trend in Secondary Education has shown poor participation in mathematics, physics, chemistry and biology among girls as compared to boys as the bulk of the girls that enroll for Advanced level education do not prefer participating in the field of science and mathematics. As a result, most of the girls have little stake in professional courses like medicine, engineering, technology and other technical disciplines which promise better economic rewards. Obviously, efforts are being made to close the gender gap so as to achieve development. Such efforts come from NGOS represented by CAMFED and from the Government itself, whose most recent intervention focused on the fields of Science under the STEM programme. In light of such efforts this research is undertaken to assess the progress that Zimbabwe has made to empower the girl child through promoting their uptake of science subjects. The study thus examines the extent of the participation of the girl-child in the science-related subjects at Advanced level in light of the Government's introduction of the STEM Programme aimed at encouraging scientific and technological education for all.

Research Objectives.

General Objective

To examine the extent of the girl child participation in science subjects and to assess the effectiveness of the STEM Initiative in closing the gender gap in sciences at Advanced Level, focusing specifically on schools in Glen View.

Specific Objectives

1. To assess the rationale behind government efforts to promote girl children's uptake of science subjects at Advanced level, focusing on Glen View's secondary schools.

2. To assess the extent of girls science uptake after the introduction of STEM in light of the need to close gender disparities in science, technology and mathematical education at Advance level, focusing on Glen View Schools.
3. To examine whether or not STEM is promoting female students uptake of science and technological education in urban locations such as Glen View.
4. To assess the challenges against efforts to end gender disparities in the field of sciences at Advanced level in the area under study.

Research Questions.

General Questions

With a particular focus on Glen View secondary schools of Harare, how effective is Stem in efforts to promote female students, alongside males, to take up science subjects at Advanced Level?

Specific Questions

1. What is rationale behind government efforts to promote the uptake of science subjects at Advanced level in secondary schools of Glen View, for instance?
2. What are the strategies adopted under STEM to close gender disparities in science, technology and mathematical education at Advanced level, focusing on Glen View Schools?
3. To what extent have the strategies adopted under STEM succeeded in promoting the girl child's participation in science subjects in urban locations such as Glen View?
4. What challenges are faced in the above mentioned schools in efforts to end gender disparities in the field of sciences at Advanced level in the area under study?

Theoretical Framework

Owen (1994) defines a theory as a thought process or way of thinking about reality which becomes a model of that reality. There are at least two important ideas that come out of the definition of the term theory by Owen (1994). These are firstly, a theory is a thought process that guides us and secondly, it can be used to explain practice and actions taken. The research is informed by the Liberal Feminism Theory and the Gender Equality Framework.

Within this context, Liberal Feminism Theory can be explained as an individualistic form which concentrates on women, their equality through being responsible for their actions and choices (Brookes, 2008). On a similar note, Giddens (2001:692) defines Liberal Theory as a "feminist theory that believes gender inequality is produced by reduced access for girls and women to civil rights and allocations of social resources such as education and employment". In her article, Alison (1983) described liberal feminism as a theory and work that focuses more on issues like equality in education, at workplaces, in political and economic rights. From the above definitions, it should be noted that the liberal feminism theory acknowledges the existence of disparities in society that are gender related but the onus is on the individuals affected to improve their situations.

Liberal feminism theory is therefore premised on a number of assumptions. These premises are based on the understanding that individual ignorance has contributed to gender prejudice. In order to address this gender prejudice, the affected individual has to take action. Education is therefore seen as a variable that can be used to improve the situation. Alison (1983) postulates that the primary goal of the Liberal Feminists is to attain gender equality in the public sphere that is access to education, equal pay, ending job sex segregation and better working conditions. She added that equality is won through legal changes. In this regard, they tend to rely much on the state and political rights to gain equality-to see the state as the protector of individual rights. Liberal feminists therefore support affirmative action legislation requiring employers and educational institutions to make special attempts to include women. Liberal feminists believe that if there is going to be reforms, such reforms have to be gradually introduced without upsetting the status quo. They have moderate aims, their view do not radically challenge existing values and as such they aim for gradual change in the political, economic and social system (Haralambos and Holborn, 2008). However, critics have raised their eyebrows, accusing Liberal feminism theorists of judging girls and women and their success in all spheres of life by male standards.

Furthermore, Gender Equality Framework (Stromguist 2007), also plays a major role in informing this research. The framework recognizes that political and social factors external to science have created barriers to female participation, and it emphasizes redress of these issues as a measure to improve the participation of females in the science subjects (Sinnes 2006). It

supports equal access for girls and women in education (Schiebinger 2010). According to Sinnes (2010:75) the framework emphasizes that, "central to this approach is to give girls and boys the same opportunities and challenges…and science teachers should play an active role in the avoidance of treating males and females differently". The teacher can make a difference if he or she assumes that girls can learn science the same way boys can, especially starting at an early stage, as this is likely to positively affect his or her approach to teaching girls and expectations of what girls can achieve in the subject. Teachers may influence the beliefs and values that pupils hold about their capabilities in science subjects.

Therefore, the two theories above places responsibility into the hands of the community, that is the state or government and the education institutions, represented by teachers as major stakeholders that should play a major role if the current condition of unequal treatment of the girl child in education arena is to be challenged and changed for the better.

Justification of the Study

Notwithstanding the limited empirical research and limited literature, it is generally accepted that the girl child has been marginalized when it comes to her participation in the science subjects at Advanced level in Zimbabwe, as in the most parts of the developing world. This state of affairs is against the reality that development will only be achieved if women are empowered so that they can be at par with man. Such parity should include eligibility to occupy influential and strategic decision-making positions as argued by feminists who advocate for the restructuring of the world's gender settings. To this end, this research is relevant as it seeks to unearth the reason behind the poor participation of the girl child in science subjects as a cause of gender inequality and underdevelopment. Not only to find the reasons behind it, but also to come up with strategies on how these girls and women of tomorrow can be encouraged to take a more active role in science education as it is one of the ways that Development Practitioners think as a solution that will lead to the attainment of development. In addition the proposed research is also aimed at closing the gap in the literature regarding the participation of the girl child in the science subjects at Advanced level in the Zimbabwean education system.

This research will therefore be justifiable and important to different stakeholders that include:

Government.

- The results of my research will be useful to the government of Zimbabwe particularly the Ministry of Primary and Secondary Education. The results will be used in the formulation of policies that are gender sensitive and those that are development oriented especially giving special attention to the participation of the girl child and women in the socio-economic and political activities of this nation. As stated in the SADC Protocol on Gender and Development (2008): Part Four: Article 14: Gender Equality in Education clearly outlined that, parties shall by 2015 enact laws that promote equal access to and retention in primary, secondary, tertiary, vocational and non-formal education. It went as far as pointing out that parties should adopt and implement gender sensitive education policies and programmes addressing gender stereotypes in education and gender based violence among others. As a result, the research outcome will push the government to formulate and implement policies that are in line with the international resolutions like those of SADC on Gender.
- Governments in many parts of Africa are aware of the benefits of female education. Education of females has a profound effect on national development. A lack of their education has been linked to low birth weight, poor health and high mortality rates in children, high fertility rates, poor family nutrition, low life expectancy, poor sanitation and high illiteracy rates. The socio-economic importance of female education at Advanced Level can thus be realized in Zimbabwe through coming up with facts from the research and availing them to the responsible authorities and government for further actions aimed at improving the welfare of the girl-child in education.
- Help the government to advance the drive towards gender equality that has become the song of this 21st century that is aimed at creating equal opportunities in all walks of life.

Non-Governmental Organizations

- The results of this research will encourage NGOs that have interest in the empowerment of the girl-child through education, to lobby and pressurize the government and any other responsible institutions for change from an informed point of view with facts at hand. The outcome of my research will definitely be used by organization like Campaign for Female Education and the Girl Child Network to pin down the government to enact laws

that encourage the enrolment and active participation of the girl-child in science subjects even at Advanced level.

- The findings will be of paramount importance for local NGOs who will use these results to source donations or funds to finance programmes that will be aimed at empowering the girl-child through education. The results will make part of their project proposals as evidence and justification for proposed projects.

The University

- With the knowledge in mind that the girl-child is marginalized in the field of science, Universities will benefit by devising ways strategies that will attract girls into science disciplines so as to balance the number of girls and that of the boys at institutions of higher learning and achieve equal participation.
- Universities will use readily available information that will be obtained from my research for their institutional planning and as material for research.

To Girl-child

- The research outcome will help the young girls to feel like taking part in the traditionally male dominated science subjects because they will be aware of the importance of their education in their future lives.
- The enactment of gender sensitive laws will be of great significance and advantage to them.

To Future Researchers

- This research will help the future researchers through making new knowledge and information available as compared to the current period of writing this document where information about the participation of the girl-child in science subjects at Advanced level in Zimbabwe is limited.

To the Researcher

- This helps to prove and improve the ability of the researcher to carry out development research.
- The research is of paramount importance as it will market the researcher.

Limitations.

1. Literature on the subject matter is limited. Not much information has been recorded so far.
2. Some of the Education officers were not willing to avail some of the information especially their reports which they called sensitive.
3. Time to carry out the research was limited considering the fact that the researcher is a full time student who has to travel to and from Midlands State University Zvishavane Campus to Harare's suburbs of Glen View to undertake field work and data collection.
4. The above problem is also linked to the limited financial resources that made it difficult for the researcher to travel from Zvishavane Town as frequently as he wanted so as to visit as many urban schools as possible in the capital city, Harare. This is compounded by the fact that the student is not employed and relies on handouts from parents to carry out the study.

Delimitations

This study only focuses on making a critical assessment of the extent to which the girl child is participating in the field of science at Advanced level in the education system of Zimbabwe. The focus is on establishing levels of participation and the reasons behind such levels of participation as according to the findings of the field work. It seeks to examine the progress made in mainstreaming gender in the introduction and implementation of the STEM initiative meant to support students who are doing science subjects such as, mathematics, physics, biology and chemistry at Advanced level in Zimbabwe.

Glen View 1 High and Glen View 2 High Schools of Harare are the case studies or the research sites. These suburbs are located west of Harare Central Business District and they make part of the highly populated areas of the city. Bulk of this dense population are youth and the economically active but with low income. With these population dynamics in mind, one would be tempted to choose this area as a case study to assess the contributions of government and Non-governmental Organizations towards the emancipation of women through education especially in science subjects. Therefore, I chose this area due to the fact that a very small area as

a research site compared to carrying out the same research in the whole of Harare or any other rural areas has the following advantage factors:

- Proximity

  Considering the limitations on finance to fund the costs of travelling, the researcher chose a place that is very much close to his place of residence. The low cost of traveling to collect data has been eliminated because the researcher can walk from one school to the other hence the schools are highly accessible. Furthermore, proximity also means that there is a lot of time that will be saved due to the short traveling distances, bearing in mind that the researcher is a fulltime student who has to balance the project work and the day to day lectures at school.
- The small size of the research site. It should be noted that the bigger the sample size the more impractical and uneconomical it becomes, (Welman, 1999). So involving a very large research area would have been a bit complicated and the research would be overstretched as it would involve a very large population. Furthermore, Nachimias et al (1985) are of the view that taking a small research sample from a large population is very convenient hence I, the researcher has chosen to go along this line of thinking.
- Distance between schools also influenced the decision to choose urban areas over rural ones. Choosing rural schools means that I was going to be in need of large sums of money for traveling and a lot of time to move around and carry out my research.

Ethical Considerations.

Research Ethics involve requirements on daily work, the protection of dignity of subjects and the publication of the information in the research. However, when research is undertaken, the one participating in the research should cope with the value systems: that of the society and his or her own as a researcher. Clark (1991) notes that these values may be in conflict with the values of the subjects, communities and societies under study and may create tensions and dilemmas during the research period. Therefore, the researcher will make sure that the following principles will be strictly taken into consideration during the course of the research period:

- Obtaining informed consent is paramount and the researcher asked for permission to carry out the research through interviews and questionnaires with the Ministry of Primary

and Secondary Education officials, school heads as well as the girls that are already doing sciences at Advanced level together with other relevant stakeholders.

- Participation was on a voluntary basis and the researcher informed the participants that they have the right to withdraw from the research proceedings at any moment they feel like. The Liberty of the research participants to withdraw from the research is in line with the dictates of the Nuremburg Code (1947) that the rights of those being researched and specifically of informants, should be prioritized when carrying out a research to avoid exploitation.
- The researcher also focused on ensuring respect for Confidentiality and Privacy of personal level information. Kelman (1977) believes that an invasion of confidentiality and privacy happens when private information such as beliefs, attitudes, opinions and records is shared with others, without the interviewee's knowledge or consent. The researcher observed respect for confidentiality and privacy through ensuring anonymity of participants by not writing down their names or any other personally identifying information. The researcher thus used pseudo names.
- The researcher also strove for honesty in all communications, that is, from the stage of recording information, reporting data, results, methods and procedures, and publication status. He pledges to avoid fabrication, falsification, or misrepresenting data.

Chapter Breakdown

Chapter 1: Introduction

Chapter 2: Literature Review

Chapter 3: Research Methodology

Chapter 4: Data Analysis and Presentation of Findings

Chapter 5: Conclusions and Recommendations

Chapter Summary

In summary, the research focuses on assessing the extent to which the girl child is currently occupying in the participation in the field of science and mathematics that are pivotal in a bid to attain economic development. It will also look into the causes of such scenarios, the strides made towards improving the participation of girls which include the work of Civil Society Groups and

the STEM initiative among others. After outlining the research findings, possible strategies (recommendations) that will help in encouraging the girl child's interest to take part in sciences at Advanced level will also be outlined.

CHAPTER TWO: LITERATURE REVIEW.

Introduction

This chapter gives a summary of relevant literature on findings used to conceptualize the research theme that is the participation of the girl child in science subjects at Advanced level. It gives an overview of the girl-child participation in science education as a tool for social, economic and political change. Literature review can be described as an objective, critical summary of published research literature relevant to a topic under consideration for research. Its purpose is to create familiarity with the current thinking and research on a particular topic, and may justify future research into a previously overlooked or understudied area. It compares, contrasts and evaluate the major theories, arguments, themes, methodologies, approaches and controversies in the scholarly literature on a subject. It also connects, compares and contrasts these arguments, themes and methodologies with the concerns of a proposed piece of research (that is the aim of the essay, research project or thesis, the research questions and the central hypothesis.) The chapter is thus divided into, the importance of educating the girl child, the current situation on the participation of girls in sciences and the reasons for the imbalances.

Why is girls-child science education important?

Education continue to be central in the country's well-being and economic development. Worldwide, science is frequently viewed as an essential prerequisite for modernization, economic development and for bringing changes in the quality of people. The centrality of women and the girl child's contribution to national development cannot be underestimated. Several studies have shown that an investment in girl's education in an investment to the family, community and nation (Adetunde and Akensina, 2008). It improves overall quality of life. Their education is particularly associated with improvement in family nutrition, lowering of fertility rates and improved chances of a children's education and increased opportunities for income earning for both wage and non-wage sectors (Kelly, 1999). In addition, the Zambian Demographic and Health Survey (ZDHS) for 1992 also reveals that the social benefits associated with secondary education especially in sciences in included lower fertility rates, later age of first marriage, greatly reduced infant and child mortality, reduced incidence of malnutrition (Gaisie et al 1993).

When the country educates it's usually marginalized young girls, economic productivity rises, maternal and infant mortality rates fall, fertility rates decline and the health and education prospects of the next generation are improved as noted by Lopez-Claros et al, (2007). Accordingly, he added that if women all over the world had a secondary education, child deaths would be cut in half, saving approximately 3 million lives. Not just girls' lives, but all lives. Christina Taylor, the Community and Bequests Officer for Plan International, notes, " All children are important, they have the same rights and deserve the same opportunities, however because girls face the double discrimination of being female and young it is so important that we focus on efforts specifically on addressing their disadvantages and systemic abuse mostly through their education"

Science is increasingly essential in all realms of life. Science as a field has attracted researchers' interest due to the particularly high status it enjoys in the school curriculum of many countries both in developed and developing world and there is a widespread present day concern about the increasing number of girls opting out of science at the point of choice. For the last two decades, the increasing impact of scientific and technological developments on everyday life has brought science education within the school curriculum to the forefront, especially issues such as scientific literacy and the relevance of science to everyday life of boys and girls, men and women in a highly competitive word. Indeed, the importance of scientific literacy has been emphasized by Millar and Osborne (1998) who have argued that the science curriculum should provide learners specifically girls with knowledge and understanding of the world they live in and which will be of use to them as ordinary individuals so as to enable them to become scenically literate citizens and benefit from and contribute to human and national development. Therefore, a knowledge of science is very important and the form in which it is taught is of universal value and it is something that an individual needs later in life not merely as a gateway to a set of career choices but rather to enable him/her to function as responsible citizens (Millar and Osborne, 1998). Despite the fact that it so widely held that science and technology are increasingly important in a globalized world, many researchers have argued about the socio-historical legacy of traditional science and science education. In the past, science was reproduced as an objective, privileged way of knowing restricted to a selected intellectual elite and excluded many girls (Eisenhart and Finkel (1998); Brickhouse, 2001).

Education is a fundamental human right, as enshrined in numerous international human rights instruments, including the 1948 Universal Declaration of Human Rights (UDHR), the 1976 International Convention on Economic, Social and Cultural Rights, the African Charter on the Rights and Welfare of a Children (ACRWC) adopted in 1999, the 1979 Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) and the 1989 Convention on the Rights of the Child. These instruments specify that gender inequalities in education should be eliminated, wherever they exist. The Article 10 of the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW, 1979) obliges States to "take all appropriate measures to eliminate discrimination against women in order to ensure them equal rights with men in the field of education, and in particular to ensure on the basis of equality of men and women …" (CEDAW, 1979)

In addition, the Department for International Development (2005) pointed out that education was recognized as a Right of a Child including girls in Article 11 of the African Charter for the Rights and Welfare of Children (ACRWC) adopted and entered into full force in 1999. With this in mind therefore, educating girls help to make communities and societies healthier and safer, and can also help to improve maternal health and tackle the spread of HIV and Aids. Vandemoortele and Delamonica (2000) noted that HIV spread twice as fast in uneducated adolescence girls, which is roughly the Advanced level stage. As such, there is every reason to vehemently advocate for the equal and more direct participation of the girl child in science subjects in Zimbabwe especially at Advanced level.

In addition, education raises awareness for the girl-child, "to be engaged as a thoughtful citizen and to become meaningfully involved in the change process as co-responsible thinkers, actors and leaders" (Mbilinyi 2000). Apart from being more than half of the world's population, women have a huge influence on the well-being of their families and societies, in a projection by Rossen and Vincent (1999) noted that from a gender perspective, the productive role burden of for example fetching water will (on women and the girls which may lead to school dropout) increase drastically by about 6 fold by the year 2080 in Sub Saharan Africa (SSA). This therefore means that girls and women will definitely have a great burden that they should carry hence they need to be educated and informed so as to be in a position to deal with the changes happening in their surrounding environments as well as the challenges coming along their way.

A General Overview.

Hakim (2008) asserted that internationally the most enduring segregation of boys and girls is in the educational system, long before people enter the labour market as women continue to prefer the field of arts, humanities and social sciences while men are more likely to choose field of mathematics, physics, and chemistry. The Programme for International Students Assessment (PISA) reports on the attitudes to science in *Science Competencies for Tomorrow's World* (Organization for Economic Co-operation and Development (OECD) 2007) and notes that, whilst many young secondary girls after completing ordinary level are very positive about the importance of science, substantially, fewer feel that science is important to them personally, or that they want to pursue a career in science. In a similar vein, the Relevance of Science (ROSE) project shows that school students in many countries, particularly those with developed economies, do not feel very positive about their experiences in sciences despite doing them at compulsory level (Sjoberg and Schreiner, 2010). There are two dimensions to the problem. The first of these concerns level of *engagement* with science. Many teachers in schools, particularly secondary schools, report a lack of interest on the part of the majority of girls on what they encounter on a day-to-day basis in their mathematical and science lessons. This lack of engagement leads to the second dimension of the problem, level of *participation.* Once the period of compulsory study has ended and decisions are made over subject choices, STEM subjects are not particularly popular choices. A percentage of A-level entries in England and Wales in the science and mathematics from 1990-2012 illustrates the problem as shown in Table 1.

Cast positively, the data shows there has been a steady improvement in the percentage of advanced level girl's entries in biology in recent years. However, entries for chemistry, physics and mathematics are still very low than they were in 1990. A notable feature with in the data is the particular decline of female students taking physics, chemistry and mathematics (Smith, 2011).

Table 1: Percentage of girls' A-level examination entries in biology, chemistry and physics, 1990-2013

Year	*Biology*	*Chemistry*	*Physics*	*Mathematics*
1990	6.8	6.8	6.2	12.8
1995	7.2	5.8	4.8	9.2
2000	7.1	5.2	4.1	8.0
2005	6.9	5.0	3.8	7.7
2010	6.8	5.2	3.6	6.5
2011	7.2	5.5	3.7	6.6
2012	7.3	5.7	3.3	6.5
2013	7.5	6.1	2.2	5.9

(Source: Joint Council for Qualifications, JCQ

Buccheri et al (2011) explored interest in science and career aspirations of more than 7000 top performing students from four high-performing countries that are Australia, Finland, Korea and Switzerland. Gender-specific differences in interest in different sciences were apparent yet varied in chemistry, there was no gender difference between Korean and Australian students but large differences for students in Finland and Switzerland. Females in Australia and Korea preferred human biology to chemistry and physics. When asked about their future occupations at the age of 30, student responses reflected a gender divide with very few females stating an interest in engineering, for example, especially in Australia and Switzerland. The UK Institute Of Physics (IOP) highlighted the low participation of females (20%) in upper secondary physics course because high achievements for females at ordinary level does not translate I to similar proportions of female continuing with upper secondary physics (IOP 2012,2013). Further, the finding that few females choose" A" level physics suggest that, "girls are making a conscious choice not to study physics" (Daly et al 2009, p. IV) even when they are more qualified. In other research, attitudes to physics were largely determined by self-concept, experiences of school physics and the presence of a personal supportive physics teacher (Murphy and Whitelegg 2006). Another research in Brazil, Argentina and Uruguay demonstrated that stereotypical attitudes such

as “mathematics, chemistry and physics are male subjects” are acting as deterrents in upper secondary school STEM enrolment for girls. This same study reported that perceptions of students’ own ability and task difficulty predict future enrolment patterns in STEM and school (Abraham and Barker, 2015b).

Education statistics in Sub Saharan African countries show that women continue to lag behind men in education in general and specifically in science, mathematics and technology education. Also, education stereotyping continues, with women and girls tending to study programmes related to so-called “women’s” occupations such as nursing, secretarial jobs and social work. Programmes in engineering, physics and the so-called “hard sciences” continue to be dominated by men and boys. Naugah (2011), when she was carrying a research on the participation of girls at advanced level in Mauritius noted that, many pupils, more particularly girls drop STEM subjects at adolescence and the real importance of science in their everyday life has not been clearly understood by many of them. This is particularly so in the case of girls despite the fact that some initiatives in Mauritius are already in progress to encourage their participation in STEM field. She further pointed out that, access is not a problematic issue in science education in Mauritius as choice of science subject at the age of 16, lower 6 depends on girls’ preference for what they would like to study but equity is an area that requires further attention. Gender equity in science education is still not well understood by many educators in Mauritius though it is being debated in other areas for example, in politics recently.

According to the World Bank (2008), Ghana is no exception, girls’ participation in science, technology, engineering and mathematics (STEM) subjects in upper secondary schools is still lower than that of boys. There are many factors that influence the girl’s participation in science, including false belief among girls that science-related subjects are more suited for boys. It also pointed out that gender disparities in the participation of girls in STEM are highest in Benin, Cote d’Ivoire, Ethiopia, Guinea, Mali, and Togo, with a fewer with fewer than 60 per 100 boys entering upper secondary education in general.

Back home, the Nziramasanga Commission Report (1999) echoed the general and worrisome absence girls in the science and technology-related educational disciplines as they progressed to Ordinary Level and worse still at Advanced level. This therefore shows that the low participation

of girls in sciences is not something new hence its high time that it should be researched and addressed.

Causes.

Rodgers and Ford (1997) pointed lack of interest and negative attitude as one cause of poor participation of girls in advanced level science subjects. They argue that despite the fact that science informs our thoughts and behaviors, many girls after completing ordinary level do not seem to place a high value on STEM subjects. Studies have shown that the general public (non science majors) do not generally have positive feelings towards science and mathematics. Consequently, many girls opt for commercial and arts subjects hence they are poorly represented in the field of STEM. Ungar (2010) argues that if female students change their attitudes towards science and mathematics, their enrolment and performance will definitely improve since they will dedicate more time and attention towards learning in this field.

According to Masanja (2010), it is important to note that the Culture, Socialization and Stereotyping also account for the poor girl child science subject uptake at Advanced level. In line with this, stereotyping of knowledge and skills given to female and male students at the introduction to formal schooling combined with marginalization and discrimination against women continues to influence the gendered nature of education especially at upper secondary level even today, thus in a way, determining the occupation of men and women. Researchers, Guiso et al (2008) established a link between the gender STEM gap and girl child socialization in society in that the way female students are socialized highly influences their decision to participate or to opt out in any Stem related field. Worth noting is the culture of the Zimbabwean society which consider science and mathematics to be masculine subjects, not a suitable choice for female students (Gudyanga, 2013). One can point to the observation that male staff in science and mathematics was 89% and female was 11% at Advanced level at national level (Zimstat, 2012).

In conjunction with stereotyping and social construction, culture also contributes to inequalities in the participation in sciences between boys and girls at advanced level. Culture is “a system of shared beliefs, values, customs, behaviors and artefacts that’s the members of the society uses to cope with their world and with one another…the collective programming of the mind that distinguishes the members of one group or category of people from others” (Hofstede, 2011). In

this context, "…if the cultures of child-rearing practices are gender-stereotyped, then boys and girls will be brought up very differently from each other" VanLeuvan, 2004). A research done by Paton (2012) indicates that mathematics anxiety is one of the reasons why very few girls study mathematics at Advanced level. He further argued that because mathematics is traditionally viewed as a male domain, females may be socialized to think of themselves as mathematically incompetent. This has led to females avoiding mathematics and related science subjects and when the girl child participate in these related subjects, they may experience more anxiety than males. Mandina et al (2013) noted that enrolment at Advanced level mathematics in Chegutu urban schools confirms that there is indeed low participation in the science field at Advanced level. In line with Paton's findings, it should be noted that mathematics forms the base of the science and technology field. Thus female students are socialized against STEM subjects. This discouragement of female students to study physics, chemistry and mathematics seems to be a culturally rooted in the fabric of society.

Asimeng-Boahene (2007) and Gudyanga (2013) claim that generally, parental expectations are a disincentive for mathematics and science education for females especially at upper secondary level. This starts well at lower ordinary levels where females tend to be given time consuming domestic responsibilities which leave them with not much time for private study. This greatly affects female students negatively and causes them to lose interest in their studies especially in mathematics because of the challenging culture of the subject. In this regard, Gutbezahl (1995 cited in Mandina etal 2013) postulates that girls tend to internalize their parents' negative expectations which becomes self-fulfilling prophecies. This is consistent with other studies where parental education and their children's attitudes towards science were correlated.

Atkinson et al (2003) and Jansen (2003) view colonial history as having left an indelible, political, economic and educational legacy. The school curriculum inherited by the post-independent Zimbabwe was modelled on the English system, with Zimbabwean girls being educated for domesticity while boys were educated for employment and the role of family head and breadwinners. Boys and girls were taught different practical and vocational subjects, with boys having to study technical subjects such as metal work, agriculture, technical graphics and building, and being encouraged to pursue science subjects like mathematics, chemistry, biology and physics, while girls were offered domestic science subjects, typing and shorthand, being

encouraged to pursue arts subjects. Eisenhart and Finkel (1998) and Brickhouse (2001) also noted that, despite the fact that science and technology are increasingly important in a globalized world, many researchers have argued about the socio-historical legacy of traditional science education. In the past, science was reproduced as an objective, privileged way of knowing restricted to a selected intellectual elite and it excluded the girl child. The inheritance of such attitudes and practices is proving to be very disastrous to girls as they have become trapped into thinking that they cannot make it in the field of mathematics, physics, chemistry and biology that is food and nutrition as well as fashion and fabrics. They were also taught typing and shorthand, and were generally encouraged to pursue arts subjects. The inheritance of such attitudes and practices proving to be very disastrous to girls as they have become trapped into thinking that they cannot make it in the field of mathematics, physics, chemistry and biology.

According to Mutekwe and Modiba (2012), enrolment is low in Science subjects especially at Advanced level because of the little attention that the girl child receives from teachers. This problem is traced back to Ordinary level in Zimbabwe. The research observed that the boy child received more teacher-initiated contact than his female counterpart. The results or findings are consistent with those reported by Whyte et al (2002) in a study of secondary teachers in Birmingham. In the Zimbabwe based study Mutekwe and Modiba (2012) discovered that generally, both male and female teachers preferred to teach boys citing that they are more active, out-spoken and willing to exchange ideas and information than girls. This clearly shows the role that gender stereotyping as well as the colonial legacy still plays even in the so called liberal education system of our nation. Mutekwe and Modiba's observation is also supported by Zohar and Bronshtein (2005) who examined teachers' knowledge and views about gender gaps in physics participation in Israel and their findings showed that teachers did not know anything about gender inclusive pedagogy. Pedagogy simply refers to the methods of teaching or a way of passing instruction to pupils. These findings also exposes the role of society specifically schools in the cultivation of gender stereotypes that lead to the marginalization of girls. Girls lack necessary encouragement and push given that they are not given the same attention similar to that given to boy child.

Furthermore, Kwinjeh (2007), Mawarire (2007) and Gordon (2004) noted that gender equality issues have not received adequate attention in the Zimbabwean studies. Very little attention has

been given to what happens to the girls when in the school walls (Machingura 2006). Francis (2000) further on presented a grim picture of the existing gender disparities in the classroom where the girls are 'marginalized and belittled'. Research has mainly focused on equality of access to schooling for girls and more recently, factors contributing to high dropout rate from schools. Concerned with this legacy, Gordon (2004) argued that equality of educational opportunities should involve not only equal access to schooling but equal treatment of boys and girls with in the school and classrooms. Chengu, (2010) asserted that equality of access without social justice for girls and women fails to address gender imbalances. Therefore, in spite of the Zimbabwean education system's claim to be liberal, it has remained conservative, discriminatory, and oppressive especially to girls and women in matters of career choices. With all this information in mind, it will become unfair to ignore the efforts of other stakeholders especially the third sector which is vigorously campaigning for the equality of the girl child in the field of education in Zimbabwe.

Conclusion.

This chapter is an account of already published information on the extent of the participation of the girl-child in STEM subjects at Advanced level from global to national levels. It serves to acknowledge the works of other researchers which helped the researcher to be aware of the information gaps that exist in this subject hence raising the need and importance of this study.

CHAPTER THREE: METHODOLOGY

Introduction

This chapter explains how the research was carried out and how the data was gathered. It covers the research design, the target population, sampling, tools that were employed in order to gather the data.

Research Design.

A qualitative research methodology was used for the purposes of this study. Burns and Grove (2003) define qualitative research as a systematic, subjective approach used to describe life experiences and situations to give meaning. It was also described by Creswell (2014) as an explanatory approach emphasizing on the use of words rather than quantification ingenerating and analyzing data). The researcher opted for qualitative research because qualitative data provides a greater depth of information that present a full picture of the influence of the extent of the participation of girls in STEM Subjects at Advanced level in government schools in Glen View suburbs that is Glen View 1 High and Glen View 2 High schools. It is the matter of inductive and interpretive explanatory approach which stresses viewing the world with eyes of the examinees. The researcher situated this study with in the interpretative paradigm which involved collecting the stories of lived experiences as noted by Creswell and Maietta (2002).

An interpretive paradigm assumes that people's actions are meaningful and that these meanings have to be interpreted in the context which they take place (McNeill and Chapman, 2005). Interpretivists believe that reality is multiple and subjective and focuses on social life interactions as perceived by individuals rather than objective reality (Blaike, 2007). Reality is socially constructed that is there is no single observed reality or interpretations to a single event.

Descriptive research was also used in undertaking this research. According to Burns and Grove 92004), a descriptive research design is a design that provides a picture of the situations as it happens naturally. Furthermore, in a bid to explain the variations in the findings as well as why things or situations are as they are, regarding the extent of the uptake of science subjects by girls at Advanced level, the explanatory research design was of great importance. It also helped in explaining the data collected from documents studied.

Methods for Data Collection.

These are the steps, procedures and strategies for gathering data in this study. Data collection refers to gathering specific information aimed at providing or refuting some facts (Tromp, 2006). In this study the following methods were used in collecting the required information: Interviews, focus groups, observations and questionnaires.

- ❖ Interviews.

Frey and Oishi (1995) defined an interview as purposeful conversation in which one person asks prepared questions (interviewer) and another answers them (respondent). It takes the form of a conversation in which the researcher probes deeply to uncover new clues to open up new dimensions of a problem or to secure vivid, accurate and detailed accounts that are based on the personal experience of the subject. This is done to gain information on a particular topic or a particular area to be researched. Interviews are a useful tool which can lead to further research using other methodologies such as observation and experiments, (Jensen and Jankowski 1991). Interviews can take one of two basic structures, they can be either structured (closed interview style) or unstructured (open interview style). Open-ended or unstructured interviews are defined by Nichols (1991) as an informal interview, not structured by a standard list of questions. Fieldworkers or researchers are free to deal with the topics of interest in any order and to phrase their questions as they think best. This type of structure uses a broad range of questions asking them in any order according to how the interview develops (Breakwell *et al,* 1995). According to Wimmer and Dominick (1997), open-ended questions allow the interviewer, if they wish, to probe deeper into the initial responses of the respondent to gain a more detailed answer to the question. The richness of the data is therefore entirely dependent on the interviewer. The researcher himself, must judge how much or how little they should probe or say themselves.

Interviews were used in collecting information from the respondents. Interviews involved oral questioning between the researcher and individual respondents. Interview is good as some respondents are not conversant with the language used. Interviews are better compliment to questionnaires because some targeted groups may be so busy and do not have time to fill the questionnaires.

The sample interviewees, that were made up of 12 Advanced level science teachers (3 from each school), 4 school heads and 20 girls participating in sciences at Advanced level as well as some 3

education officers were given explanation of the exercise and assured confidentiality and assurance that the researcher had no legal related associations. To maintain confidentiality the respondents are privately interviewed. The interviews were conducted with a subset of samples used for the administrative data collection. Appointments were made at different days to meet these target population and these interviews proved to be imperative in informing the research objectives. It should be noted that despite aiming to establish the rationale behind the underrepresentation of girls in sciences, the numbers are against female teachers in sciences as well. Much of the students were from middle class families.

Interview Format

The interview format was loosely structured to both ensure a few key questions were answered regarding the respondents' views of the existing situation, causes and impacts of the extent of the girl child enrolment in science subjects at Advanced level Therefore, the interview guides consisted of both open ended and closed questions. This also allowed for both factual and unanticipated information that is pertinent to the study to be disclosed.

Face to face interviews were held science teachers and their students. This offered the advantage that the researcher was able to take note of the non-verbal cues that is body movements and gestures. The problems of temporal states of the respondents like fatigue and anxiety were experienced. To deal with this the interviews were scheduled from 8am to 11am with a duration of 15 minutes per interview. Notes were being taken down as the interview progressed with respondents' names being withheld for confidentiality purposes.

In this research, telephone interview were also used. This was an effective way of gathering information from Ministry of Primary and Secondary Education as it was both time and cost effective. It got rid of problems of booking and scheduling meetings with officials from the Ministry of Primary and Secondary Education who might have been too busy to attend to me in person. Be that as it may, it should be noted that the interviewee's non-verbal cues were not visible. Some of the conversational questions for students were: What are your views towards STEM Subjects at Advanced level? What do you this are the causes poor girl-child representation and participation STEM Subjects at Advanced level? Are there any noticeable differences between the way boys and girls are being treated in STEM classes? How does STEM help you in your life? For the teachers the researcher asked them questions like: What are your

perceptions of girls going for STEM subjects at Advanced level? Why do more girls opt out of STEM subjects when going for Advanced level than boys? What are the causes of the poor participation of girls in sciences at Advanced level?

- Observation**.**

Observation is a systematic process of recording the behaviour and patterns of participation without necessarily questioning or communicating with the participants as described by Nieuwenhuis (2007). As a data generating technique, observation enabled me to gain deeper understanding of the way girl participate in their science lessons as well as the teacher-child interaction in a learning environment setup. The researcher was given permission by school heads and teachers to observe the lessons with the full knowledge of both participants (teachers and students). To minimize the Hawthorne effect I observed two lessons without collecting data to enable student to get used to my presence as well as building a relationship with participants in the setting. After that I then started observing and taking down notes. I joins their lessons for 2 days and lesson was for 1hour 10 minutes and I was there observing following their day to day style of conducting their education business, meaning that I followed their timetables and not imposing mine. This technique provided me with an insider perspective of group dynamics and behaviours of female students in different settings and allowed me to hear, see and experience (observation) and reflect (which is part of the interim data analysis) how setting is socially constructed in terms of "power, communication line, discourse and language". It also served as a technique of verifying or nullifying information provided in face to face encounters. Observational data was therefore very useful in overcoming discrepancies between what people said and what they actually do and it helped me to uncover behavior which the participants themselves may not be aware of. The only challenge was that I have a feeling that students were cautioned on how to behave especially by their teachers. However, use of other techniques like interviews and questionnaire helped to neutralize the challenge.

- Questionnaires.

A simple definition of a questionnaire can be as follows, it is a list of questions that are related and these questions must relate to the topic under investigation. Questionnaires are most frequently a very concise, pre-planned set of questions designed to yield specific information to meet a particular need for research information about a pertinent topic. The research information

is attained from respondents normally from a related area of interest. There are various types of questionnaires and their names are derived from the way they are send to respondents.

In this research, a total of 20 questionnaires were used in the process of data collection. The following are the types of questionnaires that the researcher made use of in the collection of data:

Mailed questionnaire- the researcher made us of electronic mails (emails) to send and receive questionnaires. The process was very fast, when considering the time factor, very cheap as the researcher did not have to travel from one place to the respondent's physical location.

Self-administered questionnaire- this is when a questionnaire is handed to the respondent who in return complete it on their own and at times in the presents of the researcher just in case some problems may arise hence the researcher would cheap in and assist. Despite having the advantage that the researcher can assist the respondents, the process proved to be time-consuming and energy sapping as the researcher had to visit the respondent's physical location. Some of the respondents could not turn up in time as scheduled.

- Desktop Surveys**.**

The researcher made use of desktop surveys as it was an effective way of gathering background information on the subject under study. It gave me the opportunity to get access to some important documentations prepared in the past that were still relevant to this area under study. Desktop surveys proved to be effective in my research because I managed to compare and contrast the past and present situations in as much as the participation of girls in STEM subjects is concerned. In addition, it was very much useful in searching for information required for literature review on the subject under study even from a global perspective. The major worry here was that, much of the information available through desktop surveys is invalidated, everyone can upload anything hence is not one source that a researcher can solely rely on. However, the researcher made use of academic papers like pdfs and journals. In addition, other tools like observations, interviews and questionnaires were used to combat the problem.

Target Population.

A target population is defined by Cohen and Manion (1990), as a target group used in a study. It can also be referred to as research unit or sample unit. This is the group which the researcher is interested in getting information from and drawing conclusions. The term population itself refers

to the establishment of boundary conditions that specify who would be included or excluded from the study. In this case therefore, the research was carried out in government high schools that offer science subjects at Advanced level at Glen View 1 and 2 High Schools with specific concentration on the girl child who have already enrolled for STEM subjects.

Sample Size.

Among those girls doing sciences at Advanced level, the researcher used a sample size of 10 girls from each of the 4 schools used for the study. Of these 10 girls, 5 were the best performing and the other 5 were those from the other end. School heads and 3 teachers from each school contributed well by providing the researcher with ideas about causes, effects and remedies according to their experiences in dealing with these girls taking on STEM subjects in schools.

Sampling Technique.

Sampling is very important as the population tends to be large while resources and the time available are limited. Sampling seeks to demonstrate representativeness of findings through selection of some subjects, in other words it is aimed at seeking information from specific relevant groups and subgroups of people in a population. Hence it was not be possible to study and get information from each and every individual falling under the research subject in particular, everyone who is doing science subjects at Advanced level. It is from the sample that projections, explanations and statistics or data in general regarding the entire population was produced and as such the sample was representative.

Purposive sampling was used in this study. It involved the selection of respondents which researcher judged as the most appropriate ones for the study. Doodley (1995) noted that the ideal scenario in research would be to gather information from all elements of the population which is called census. However, censuses are very expensive and time consuming such that they are normally done by governments with funding from several non-governmental organizations, especially when it involves a large population. The chance that a particular respondent can be selected for the sample depends on the subjective judgment of the researcher. In line with this argument, purposive sampling was used in this study, allowing the researcher to directly go to Glen View 1 High and Glen View 2 High government schools. In addition, key informants from the community such District Education Officers, School Heads and Teachers specifically attached to the department of sciences at Advanced level were selected purposively in order to

explore their experiences, attitudes and opinions on identifying and dealing with children on in their enrolment and participation in science subjects at Advanced level in their schools. The sample I used was influenced by the fact that whether one is or not a direct participant in the STEM field for instance teachers and students.

The chosen sample should therefore represent the population under study. In this case purposive sampling is when subjects are selected because of some characteristics. In this respect the sample where by girls who are seen to be performing well as well as those at the other end. Purposive sampling saves time and money in this regard the researcher knew the number of respondents to interview and purposively sampled the children who are under study. Purposive sampling permits the selection of interviewees whose qualities or experiences permit an understanding of the phenomena in question, and are therefore valuable. Purposive sampling is popular in qualitative research as it starts with a purpose in mind and the sample is thus selected to include people of interest and exclude those who do not suit the purpose. The researcher had the purpose of analysing the extent of the girl child enrolment and participation at Advanced level hence consequentially the researcher targeted those children that is the girl child taking part in sciences at upper secondary education and those who are directly in contact with these girls.

Conclusion.

The researcher gathered data in the field using qualitative research method and techniques. The data was then processes and analysed so as to come up with meaningful explanations on the extent of the participation of the girl child in STEM subjects at Advanced Level in Zimbabwe. These explanations collected in the field were presented in the next chapter.

CHAPTER 4: DATA PRESENTATION

Introduction

This chapter is a general outline of data that the researcher collected in the field. It includes discussions on the rationale behind the efforts to promote girl child science uptake and the extent of girl child participation currently. It is also a compilation of the responses to the interviews and questionnaires as well as the observations that were conducted on Glen View 1 High and Glen View 2 High Schools of Glen View District under the Harare Metropolitan Province on the current causes of extant patterns of girls' uptake of science subjects. It also analyses the effectiveness of the government of Zimbabwe's STEM Initiative in promoting the female students' uptake of science subjects at Advanced level of education based on accounts of respondents consulted through field research.

The rationale of STEM at Advanced level in Zimbabwe

According to the 2016 A-level STEM Initiative Report (2016), the government of Zimbabwe launched the STEM Initiative as an effort to promote the uptake of science subjects at Advanced level in secondary schools. This was a direct response to the President, R.G Mugabe's remarks that there is need to equip learners with the knowledge and values that guarantee economic growth and increased opportunities for employment creation; well-rounded citizens who are relevant nationally and competitive globally. To this end, the STEM Initiative (Science, Technology, Engineering and Mathematics) was introduced with the following objectives:

- To train and develop cutting-edge skills to meet Zimbabwe's industrialization quest and make the country competitive globally.
- To promote STEM career in response to Zim-Asset's Value-addition and beneficiation thrust.
- To stimulate interest in Mathematics, Biology, Physics and Chemistry as foundational pillars for STEM.
- To increase the number of STEM students who will enroll in STEM degree programmes at the country's Universities in 2018.

The rationale behind the promotion of the girl child participation in STEM subjects at A-level.

Education continue to be the epicenter of any nation's well-being and economic development. In the context of Zimbabwe, the government realized that the nation is currently faced with an economic decline and deindustrialization, a situation that can be attributed to a lot of factors but one of them is the shortage of human capital in the field of science, technology, engineering, mathematics and other science-related or technical fields that can support the national quest for the revival of the economy through the process of industrialization. With this in mind, the respondents from the Ministry of Higher and Tertiary Education, Science and Technology Development (MOHTESTD) pointed out that it should be realized that much of our population as a nation is comprised of women who contribute to nearly 52% in a an estimated population of 13,2 million people. Despite the numbers being in favour of women, they find themselves marginalized in each and every field that one can think of, be it in politics, trade, leadership positions and influential post at any institution which can in one way or the other contribute to national development. Therefore, Zimbabwe could have been underestimating the power that lies in these figures when translated to human capital and seemed to have been missing the talent and ability that lies in the women, hence the need to turn to them and educate them in science with the hope that they will play a paramount role in the industrialization process of Zimbabwe. The emancipation of the girl child will have a trickling effect in the economic, social, political, intellectual and industrial development of the nation as already spelt out in Chapter 2 (two) on the reason for promoting the girl child.

Why STEM is funded by ZIMDEF?

Some may ask themselves why the STEM Initiative's funding responsibility was given to the Zimbabwe Manpower Development Fund by the Government of Zimbabwe through the Ministry of Higher and Tertiary Education, Science Development (MOHTESTD). The simple answer is that it is very legal and in the jurisdiction of the Zimbabwe Manpower Development Fund to mobilize and deploy the financial resources to fund the STEM Initiative in terms of the Manpower Planning and Development Act (Chapter 28:02) as it has been mandated by the Government through the Ministry of Higher and Tertiary Education, Science Development (MOTHTESD) which is responsible for the production of human capital through universities, colleges and polytechnics.

The Current Situation on the girl child participation in science subjects at Advanced level at Glen View 1 High School and Glen View 2 High Schools.

Despite great efforts being put to give girls greater access to education in science, technology, engineering, mathematics among other technical subjects, globally and in Zimbabwe as well, so many researches have shown that girls are still significantly under-represented especially in physics, engineering, chemistry and computer sciences. Even with greater access to science being achieved in some countries, mostly developed, as a result of intensified lobbying and advocacy work by various stakeholders like the Civil Society Organizations (CSOs) and Non-Governmental Organizations (NGOs), it should be noted that girls have not increased in their numbers. In line with this, one can support this argument using the case of Zimbabwe where the extent of the girl-child participation in science subjects at Advanced level is still in a worrisome state with girls still underrepresented and dominated by boys in both the Lower Sixth and Upper Sixth Science classes of Glen View 1 and Glen View 2 High schools in Harare (schools that were under study). This is despite the introduction of the STEM Initiative by the Government of Zimbabwe to promote the uptake of science subjects at advanced level, which makes pursuing STEM subjects at Advanced level free of charge.

Table 2: STEM Statistics for Glen View 1 and Glen View 2 High Schools.

School	**Year**	**Number of students in class**	**Number of girls in class**	**Number of all students funded under STEM**	**Number of girls funded under STEM**
Glen View 1 High	**2015** (before STEM)	37	13		
	2016 (1st STEM Class**)**	53	24	45	17 (38%)
	2017 (2nd STEM Class)	60	29	49	23 (47%)
Glen	**2015**				

View 2 High	(before STEM)	23	8		
	2016 (1^{ST} STEM Class**)**	48	14	23	6 (26%)
	2017	52	18	28	11 (39%)
Overall	**2015**	60	21		
	2016	101	38	68	23 (34%)
	2017	108	47	77	34 (37%)

Table 2 above shows the comparison of the numbers of students taking on sciences at Advanced level at Glen View 1 and Glen View 2 High schools from 2015 to 2017 as well as the number of students being funded under STEM and lastly the number of girls that have benefited from the STEM Initiative. The steady increase in the number of girls that are participating in sciences at Advanced level in Zimbabwe can be attributed, to some extent, to the role that the government of Zimbabwe's STEM Initiative has played. The Government of Zimbabwe through the Ministry of Higher and Tertiary Education Science and Technology Development (MOHTESTD) should be commended for the role it has played through the introduction of STEM Initiative. In this regard, one should note that in 2016, the inaugural year that the initiative was launched, 4199 students benefited from all the 10 provinces. Of these, the gender distribution at national level was as follows; 2770 (66%) were boys and 1429 (34%) were girls that enrolled for Advanced level sciences doing mathematics, biology, physics and chemistry under the sponsorship of ZIMDEF, (2016 A-Level STEM Initiative Report 1, 2016). The report went to state that the gender distribution was biased towards male students probably because male students are willing to take up challenging science subjects as compared to their female counterparts.

In the general observation on this subject of the extent of the participation of the girl-child in sciences, one has to be aware of the fact that Glen View 1 High and Glen View 2 High schools have registered some steady increase in the number of girls that are doing sciences as has been noted since 2015. The year 2015 saw a very small number of students taking part in sciences with both schools, Glen View 1 and Glen View 2 High Schools having 60 science students with only 21 being girls. However, one can note the increase in the numbers, starting from 2016 where the number rose to 101 with nevertheless, marginal increase in the number of 38 girls in the science classes. This pattern continued to unfold into the 2017's Lower 6 enrolment which saw the number of girls increasing to 47 out of 108 science students.

At Glen View 1 High School, in 2015 the class has 13 girls out of 37 which sharply rose to 24 in a class made up of 53 students doing sciences in 2016 (with 17 of them being funded by ZIMDEF under the STEM Initiative as the first group of students to benefit since its launch in January 2016). In 2017, there was an increase again but this time very slight to 29 girls in a class of 60 amongst them 23 being STEM Initiative beneficiaries. In the same vein, Glen View 2 High School, despite in smaller numbers also witnessed a slight increase in the numbers of girls who are in the STEM field. In 2015 the form 6 class had only 8 girls out of 23 students, which increased to 14 out of 48 in 2016 with 6 of the 14 joining under the ZIMDEF STEM the funding or sponsorship. In 2017, the lower 6 science class enrolled 52 students of which 18 are girls with 11 of them being funded under the STEM Initiative.

Effectiveness of the STEM in promoting girl child science uptake.

The research also looked into the effectiveness of the STEM in the promotion of female students' uptake of sciences at Advanced level in Zimbabwe. It is very much clear that there is not much change concerning the number of girls opting for science subjects even after the introduction of the STEM Initiative. This is supported by an increase of 6 girls from a total number of 17 in 2016 to 23 in 2017 at GV1. In 2015, GV2 had 6 female students and the number has increased to 11 because of the support that the girl-child got from the STEM Initiative. From this evidence, one can agree with the optimistic projection by teachers and officials from MOHTESTD and ZIMDEF who participated in this study, that there will be a steady but continued increase in the number of girls taking up science subjects at advanced level. With the passage of time, such increases will continue to be spurred by the STEM Initiative's which

removes the burden of tuition fees for students who enroll for Advanced level science in Zimbabwe.

Adding on, with the few that are already doing STEM subjects, more than half of them from individual schools are doing a combination that include biology. Here, girls are showing a very strong interest in human science careers with a bias towards the health sector. Girls pointed out that they considered biology as a less specialized subject which they opted for because they had diverse ambitions. The interviewed girls concurred that other science subjects are not only more specialized but attract those aiming for applied science courses, who are mostly boys. In direct contrast, very few have opted to do physics which is dominated by boys. It was noted also that mathematics is an integral subjects for these girls that have enrolled for sciences from 2016 and 2017. A good example is that, for the 20 girls that were interviewed, all of them were doing mathematics and 17 were doing chemistry which takes us to the simple conclusion that the majority of girls that are participating in the STEM field are doing the MBC combination (mathematics, biology and chemistry) as compared to MPC (mathematics, physics and chemistry) which was chosen by only 7 girls at GV1 and 3 at GV2.

Causes of the imbalances

Having noted without any doubt that there is an uneven distribution in the representation of girls participating or enrolling for sciences at Advanced level, there arose the demand to explore and investigate the possible causes of the situation. In a bid to understand the reasons behind the under-representation or the inequalities that exist between boys and girls that are participating in science subjects, the researcher compiled the following information provided by respondents through interviews or questionnaires:

- School culture.

Students nominated their schools as the most influential in sustaining their interest in science at Advanced level, referring mainly to the science culture of the school. One respondent when asked to identify and rank the factors that influenced their interest in science said, “probably school culture first…that is what they push you to do”, referring to the emphasis and the way sciences are highly regarded. She added, “I think there is a lot of emphasis on science at school. It is definitely where they try to steer and influence people”. In addition, other respondents also

mentioned other opportunities that fall to the people in the field of sciences such as the Harare Metropolitan Province Science Competitions as a factor that influenced their choice as noted when one said, “everyone says the science department is so good; if you are a bit unsure of what you should do at Advanced level, do sciences”. In line with the idea of the school as an important factor to motivate or demotivate girls from participating in sciences in Zimbabwe, one CAMFED official admitted that the low representation of girls in science classes reflect or represent the failure of the school or education system to put in place mechanisms to motivate and encourage girls to participate directly and actively in the STEM field, mostly at an early secondary level.

- ❖ Teachers and the attention they give to girls**.**

Teachers were also pointed as factors that influenced the girl-child’s decision whether to or not to continue doing sciences at school. Most of the participants described their teachers as knowledgeable, having good explaining skills, a sense of humor and lots of caring. It is important to note that these characteristics were written down on questionnaires spontaneously by female students, on the section which inquired about the way they interact with, as well as the way they are treated by their teachers. In an interview, one student explained that her Ordinary Level experience prompted her to take up science, particularly, she stressed that “our teachers really know how to teach sciences… they know what you need to know and how to make you know it...” Respondents also mentioned the teachers’ abilities to help students to appreciate relationships between what happens in the classroom and the real world. One respondent explained that “the teacher does not just tell the concepts, he sort of extends us. So we talk about a concept and then he will give lots of really good real life examples. This directly stimulated my interest into science even before l got my Ordinary level results and now look at where l am.” However, there was a general consensus amongst girls on the fact that boys get much of the teachers’ time and attention as compared the girls.

In addition to the above information, teachers who show professionalism and passion with the subjects help students to get involved in the subjects and teachers who give full attention to girls motivate them to like sciences most. According to Mutekwe and Modiba (2012), enrolment is low in science subjects especially at Advanced level because of the little attention that the girl child receives from teachers. Despite a few teachers admitting to the fact that they give much attention to boys, almost all consulted girls stressed the differences in the way that boys and girls

are treated and the way these two groups interact is in favour of boys. This accounts for the relatively low uptake of sciences among girls in Harare's high density schools as represented by Glen View 1 and 2 high schools. Informants stress that this discriminatory treatment begins to shape possibilities of science uptake at ordinary level and as one male student observed from his observations in his own classes:

> *I observed that girls are more like passengers when it came to maths, biology, physics and chemistry in our class. Not many of them participate especially when it comes to voluntary presentations. They have always seemed to be outwitted by boys. I also see that even though they lag behind, they are not staying for some extra-time lessons as we, their male counterparts do.*

- ❖ Family background and parental expectations.

Family influence and parental expectations were highly rated as drivers which influence girls to choose the combinations they will pursue especially at advanced level. 3 out of the 5 girls interviewed at Glen View 2 High pointed out that with much pressure from family members and parents expecting them to study towards the so called highly paying science careers, they could not resist such expectations. The scientific role model effect in the family also plays a role. An illustration is that of girls whose family, be they parents and siblings, are in the science field and thus grow up with family role model have a bias towards science at advanced level. One girl pointed that she already wanted to be a lab technician when she was in form 2 because that is her father's occupation. One teacher also supported this view citing that some of these girls' parents emphasized the need to motivate their children to be more serious in sciences at school because of their expectations. Two participants described their relationships with their older siblings and explained that:

> *My brother has gone through everything that I am going through in terms of school stuff. I can trust my brother to give me the right explanations when I do not understand the teachers' explanations. I absolutely look up to him and so anything he did I want to do as well. Itis not just about learning; it is about having fun with my brother while emulating him.*

This is however not unique to the field of sciences only, children are influenced by parental expectations and family background when making decisions on which career path to follow. In

line with this, Robertson (1988) pointed that some researchers' claim that STEM subjects are not seen by many parents without any science background as congruent with female sex-roles identity, a problem exacerbated whenever career-related choices must be made at such ages as early adolescence.

- Peers.

Teachers highlighted the great contributions of peers and friends in determining which subjects to take at school. Girls have developed some groups in which each and every one is good in one aspect or the other in the field of science. Because of this, they complement one other, push and pull one another. The Glen View 2 Upper class demonstrated this aspect. Most of them started playing together years back when they joined the form 3 science class and developed tighter ties.

- Interest, Attitude and Confidence.

One official from the Ministry of Primary and Secondary Education (MOPSE) pointed out that, most of the girls lacks interest and confidence in themselves, they think that it is not easy for them to do science subjects after passing these subjects at a stage when it is compulsory, that is at Ordinary level. She pointed that girls don't expect themselves to be smart in technical subjects. Girls think that they are not expected to take part in this area, and it is as well reinforced by the education system quite often. For instance, one officer from Campaign for Female Education (CAMFED) cemented this view by saying when their organization was carrying a research, girls were asked to draw a scientist and the majority of them went on to draw a men, portraying the belief that girls cannot do well in sciences. With such mentality, parents and teachers may try to motivate girls to go for sciences but when these girls are not interested, changing their minds will be a mountain to climb.

In addition, as girls grow, it was noted that they grow a "we can but I cannot" paradox: where girls can collectively defend the abilities of their sex in general terms publicly. However, it was noted that they are very hesitant about their own individual potentials.

- Stereotyping and Socialization.

Stereotyping is another reason that explains why girls are outnumbered by boys in science subjects at advanced level in a phenomenon called stereotype threat. At school level itself, the use of stereotyped textbooks are a schooling feature that cultivate inequalities between boys and

girls. These textbooks portray girls as passive, dependent, weak, fragile and even mindless engaged in non-remunerated low prestige occupations. These have profound negative effects on girls venturing into and achieving into the traditional male subjects and they start to see these subjects as too masculine, too difficult, requiring too much strength to execute and too prestigious for a girl or women. Some teachers were even honest enough to admit the cultivation of traditional roles for girls and boys although some did that unintentionally.

In addition, turning to the society, I have realized that the society itself is a cultivator of social inequalities that will have profound negative impacts on the lives of girls in the long run through gender socialization. It has tended to breed a rigid and segregated society that views gender as a determinant of one's future role, education, training and employment resulting in the girl-child being confined to indoor education. This has denied so many girls a myriad of opportunities in education, training and work. Technological understanding has been mistakenly pointed to as primarily for males. One responded emphasized that the technological understanding of the society excludes a large section of the population from contributing effectively to the society advancement. He reminded me of the statistics on the national population statistics, that with women contributing to around 52% of an estimated 13.2 million people, Zimbabwe seems to be losing out on the benefit of women's potential talent. At a family setup, stereotyping science subjects as a masculine is perpetuated in so many aspects of life for instance, at an early age, all games that are seen as aggressive and that need power is associated with boys and those that are soft are dubbed feminine.

- Cultural Beliefs.

Cultural beliefs that science, technology, engineering and mathematics are male domains act greatly as barriers to girls' and women's participation. Correll (2004) asserts that in fact, when cultural beliefs about male superiority exist in any area-even when a researcher invents a factious skill and tells subjects that males are better at it-girls assess their abilities in that area lower, judge themselves by a higher standard and express low interest in participating in that area than boys do. These findings support the position that cultural beliefs about gender can influence our self-assessment more than the actual performance does and contribute to fewer girls than boys willing to participate in STEM education.

What are the strategies that have been adopted under the STEM Initiative in the efforts to promote the equal participation of girls in science subjects?

First and foremost, it is very important to point the fact that, like much of the policies that the government of Zimbabwe has implemented, the STEM Initiative not directly gender sensitive. This is so because it does not have any mechanism or any special provisions that are only in support of the girl child. However, the initiative since its introduction in 2016 seeks to encourage students both boys and girls who sat for their 'O' Level examinations in 2015 and obtained a Grade 'C' or better in Mathematics, Biology, Physics and Chemistry to take a combination of these STEM subjects, with the Ministry of Higher and Tertiary Education, Science and Technology Development (MOHTESTD) through the Zimbabwe Manpower Development Fund (ZIMDEF) paying tuition fees and boarding fees at Government, Mission and Council Schools.

With the above information in mind one can clearly say that the STEM Initiative encourages girls to take up sciences at Advanced level because it has reduced the grades that are required for one to qualify for entry into lower 6 science classes. In addition, with our African mindset of a patriarchal society where boys' education is prioritized over that of the girls in the event of scarce resources in a family, the pledge by the government to pay for those that have passed "O" level will go a long way in promoting girl child science education.

Challenges faced in the promotion of girl child STEM education.

The STEM Initiative despite being a commendable intervention by the government of Zimbabwe to address the problem of the shortage of scientists that are relevant in the quest to industrialize, it has got its shortfalls in as much as trying to close the gap that exist between boys and girls in sciences at "A" level. Regardless of the fact that women constitute almost 52% of the total population of Zimbabwe there is no direct section or mechanism which give preference to the cause of gender balance in the promotion of sciences. Secondly, it is not a strategy that addresses the problem from its roots, it has been criticized for being exclusive in that, it is funding "A" level science students without paying attention to the junior levels like "O" level where these prospective scientists that they sponsor at a later stage in the education hierarch. Because of this, a lot of girls are opting out of sciences when they start "O" level (at form 3) where they choose to do arts or commercials because of scarcity of resources. Girls are sacrificed at the expense of the boys under such circumstances. Therefore, the numbers for the girl will remain low as

compared to that of the boys because have all the support that they need at the expense of the girls hence there will be fewer girls to qualify for the STEM Initiative when they reach Lower six stage.

Continued gender role stereotyping of science subjects. Teachers are continuously setting up rigid school structures that allocate non science subjects that are those in the field of commerce and arts to girls and science subjects are mainly left for boys. Girls are discouraged to participate in science by mostly their teachers. This is mostly because these teachers were shaped by that same culture that is discriminatory in their nature, they feel it normal to deny girls the chance to participate in science.

The girl child's image (Eccles, 1994) of femaleness as conceived by a wider spectrum of the African culture is acting as a stumbling block to the promotion of the girl child science education. Chimwayange (2005) in his research pointed out that Zimbabwean groups' way of life is embodies in the philosophy of African humanism (Unhu/Ubuntu) standing for the groups' expected way of life. Unhu/Ubuntu is premised on the essentialist notions of gender difference pointing that since and women are created biologically different, they should occupy separate but complementary roles in society each with its own sphere of activity and power. In this context, patriarchy in Zimbabwe has dominated everything including the science and technical fields to an extent that girls have come to belief that is not normal and against culture to do what has been commonly known to be the man's role hence they have an image of the in other field which are neither sciences nor technical.

Dropping out of school early for girls has also been challenging the promotion of girl child participation in sciences at Advanced level. Girls are forced out of early school for instance because of early marriages and financial constraints. As a result, the base from which female scientists should come from shrinks hence the males continue to dominate the field of sciences.

Conclusion

In summary, it can be argued that with mentality of upholding our culture and the traditions and expectations of the society as well as the weaknesses of the initiative, like the failure to put forward a clear strategy to promote the participation of girls in sciences at Advanced level there is nothing that the STEM Initiative can change. However, there is a lot of potential as noted by

the slight increase in the number of girls joining the science classes after the introduction of STEM.

CHAPTER 5: RECOMMENDATIONS AND CONCLUSIONS

Introduction

After coming up with much information supporting the fact that the girl child has been under-represented in as much as their participation in STEM subjects in concerned. With causes having been outlined, chapter therefore, is concentrating on outlining the possible solutions or recommendations that the government, schools, other stakeholders like Non-governmental organizations can adopt in order to improve the number and to generally promote the participation of girls in science subjects. It will also outline the conclusions that the researcher made during the study period. It is more of a summary of the study.

Restating the Objectives of the Study

- To examine the extent of the girl child participation in science subjects and to assess the effectiveness of the STEM Initiative in closing the gender gap in sciences at Advanced Level, focusing specifically on schools in Glenview.

Specific Objectives

- To assess the rationale behind government efforts to promote girl children's uptake of science subjects at Advanced level, focusing on Glen View's secondary schools.
- To assess the extent of girls science uptake after the introduction of STEM in light of the need to close gender disparities in science, technology and mathematical education at Advance level, focusing on Glen View Schools.
- To examine whether or not STEM is promoting female students uptake of science and technological education in urban locations such as Glen View.
- To assess the challenges against efforts to end gender disparities in the field of sciences at Advanced level in the area under study.

Conclusions

With this research coming to an end, there are a number of conclusions that can be drawn from the topic under study that is, the extent of the girl child participation in Science, Technology, Engineering and Mathematics. The following are the conclusions:

- There have been a lot of projections that have been pronounced concerning the high future demand of scientists, technicians, engineers, mathematicians as well as other personnel affiliated to the field of sciences due to projection in increase in the activities and opportunities that will rise in the most economies for example the through industrialization, economic growth and scientific-related production. This informs the abrupt shift to the promotion of Information, Communication and Technology as well as STEM-based education and economy.
- The low participation of girls in the field of STEM is not unique to Zimbabwe. It is a phenomenon that is affecting all the developing countries especially in Africa. In line with this, one should also note that even the developed world is facing a decline in the number of girls taking up sciences especially at advanced levels. The information therefore points to the conclusion that low participation in sciences is a global threat to development so many nations.
- Zimbabwe's STEM Initiative has got the potential to attract a lot of girls to participate in sciences at both Advanced level and Tertiary Education Level provided that it starts funding the girl child from the lower levels of education for instance starting from at least form 3 (three) where a lot of specialization in subjects start. At Tertiary level, science education seems to be a bit expensive as compared to arts and commercials. Because of this, the STEM will be very much successful in their quest to *stematize* the nation and meet the demand for STEM graduates and to industrialize if they extend their funding up to the students in sciences up to Institutions of Higher Learning (IHL).
- Girl child's participation has been greatest in biology worldwide, with very small number taking on physics. Mathematics and chemistry are fairly preferred and a sizable number of them are doing them.
- Explaining the real reason behind the under-representation of girls in sciences in complicated. It involves a lot of players and parties, from parents to schools, peers, society, teachers and children themselves. Therefore, understanding the causes for such situations should not be focused only on a single determinant.
- Efforts to encourage and promote the science subject uptake by girls should include a number of players. These include the Government and its ministries and department concerned with the rights of children, non-governmental organizations or civic groups,

schools, community members, and teachers. Girls and boys should be at the forefront, encouraging each other that they can both do well in sciences.

- The African culture which put much emphasis on patriarch in all spheres of life has played a big role in intimidating women and girls from taking part in the so called traditionally male dominated fields of science, technology, engineering and mathematics. As a result, girls feels that it is something abnormal for them to do whenever they think of becoming scientists hence they start to confine themselves to areas that are deemed feminine, or perfect fit for women for instance the field of arts and commercials.
- The idea of gender sensitivity has not yet sank into the minds of most teachers in schools who keep on perpetuating gender stereotyping by allocating subjects and roles as well as treating boys and girls according to their sexes instead of their abilities and capabilities. Therefore this warrants for the pre and post teacher training with great emphasis on gender issues so that they will be equipped with as much knowledge that will help them to shun gender-based discrimination in classes and in subject and role allocation at schools.

Recommendations.

In a bid to deal with the problem of poor participation of the girl child in science, technology, engineering and mathematics, below are the suggested solutions or proposed recommendations. These were proposals aimed at addressing the inequalities that exists as well as encouraging girls to take an active role in the reindustrialization process of our nation. The following therefore becomes the recommendations:

- The STEM Initiative should have a clear provision or mechanism that gives a certain proportion to be occupied by girls. The proportional representation will enable girls to feel encouraged by having the knowledge that there is a place waiting to be filled in by them hence they work toward occupying that reserved space. This is in line with the national gender dynamics of our population which is dominated by women hence under normal circumstances, girls as many as they are as compared to boys should be the ones dominating the statistics of people being sponsored under the STEM Initiative. This will feet well the philosophy gender inclusiveness and Gender and Development (GAD), that

in recent years many has adopted as a developmental solution. (Came in a realization that women and men together play a paramount role in the development of any country).

- The STEM Initiative should be extended down to lower levels of secondary education. This is to rescue and support students that are not affording to continue with their education specifically in science. Much of these are girls that are at the receiving end, the drop out of school due to lack of funding with much of them being bright young ladies with great potential to do well on sciences and they would be future scientists and industrialists to change the face of our economy. Funding girl child science education means a steady flow of science-minded girls from lower classes to upper classes.
- The Ministry of Higher and Tertiary Education, Science and Technology Development and the Ministry of Primary and Secondary Education in collaboration with other stakeholders like Non-governmental Organizations aligned to matters of education and children's rights like CAMFED and Girl Child Network should vehemently and vigorously campaign for girl child science education in every public place. They should clearly emphasize the point that girls can be technicians, scientists, engineers and mathematicians too. These stakeholders can do this by carrying around and displaying images of female scientist at work to attract the attention of young people. They should as well explain the different fields of STEM as well as the value it offers to the economy as well as to clearly state that girls can do much just as boys do in this field.
- A vigorous teachers' training should be undertaken to address the problem of shortage of science personnel science subjects at school. Government should intervene to fund this campaign. The whole essence of this idea is that, the increasing number of students enrolling for sciences should as well match with knowledgeable and experienced teachers in their numbers in order to meet the international standards of education concerning the teacher-student ratio. The smaller the number of students the better especially for girls for they will have the much attention they are lacking today in the field sciences. Teachers training should also be gender-centered, to deal with the issues of spreading the gender-based discrimination tendencies in classes, consciously or unconsciously, intentionally or unintentionally by advocating for the maintenance of sex role. When teachers become gender sensitive, they know how best to treat both boys and girls hence increasing the interest and confidence of girls in science subjects.

- Schools and parents at community levels, should by all means put some effort to expose girls to successful female role models who have excelled in the STEM field. The idea behind this is that, when girls learn about and interact with such successful people, it helps to contradict negative stereotypes and to counteract the misconceptions held by many that science and technology are more appropriate for boys than girls. Use of role models also helps in changing the negative images that girls develop about themselves when it comes to their performance in sciences.
- There is need for the restructuring of the society so as to challenge the notion and the belief that sciences and technical subjects are masculine suggesting that it is out of our culture to leave girls participating in science, technology, engineering and mathematics (traditionally masculine subjects). Because of the reason that this belief was socially constructed, I believe they can as well be reversed socially through public education with emphasis on the value of science being outlined.
- School cultures need to be restructured to accommodate girls at secondary level. This is done to foster a supportive, stereotype-free learning environment. To create such environments, schools and science centers must work to understand how gender bias work at both personal and institutional or organizational level. Schools can also do this through improvement in the facilities that the school offers and the attention that science education is given in schools. There is need for more laboratories and more technicians that can attract the interest of girls. Girls have proved to be great lovers of attention, creating a conducive environment with a lot of emphasis in sciences with the girls as the major targeted participants will attract their attention and interest to take part in this field.
- Career guidance outreaches can be used as an instrument to educate the girl child especially on the careers that they can pursue with their qualifications in the field of STEM. As I was collecting data I discovered that girls think that there are limited careers that they can go for in the field of sciences as compared to arts and commercials.
- Illegalizing all practices that hinder the realization of the girl child's right to education. These include child marriages and child labour. These force girls out of school at an early age, denying their right to education, even further undermining their future. A lot of under-aged girls are in homes working as housemaids while others are have already been impregnated and are now parents at a time when they should be concentrating on their

education. Such anti-progress practices warrant for a very stringent policy that whenever tempered with, one should face a very heavy punishment.

- Provision of incentives to girls who have are participating in sciences at Advanced level will encourage a lot of girls to take up sciences up to upper secondary level.
- The government and its departments should support girls through providing opportunities for girls to participate in for example Provincial and National Science Competitions that allows them to develop their spatial skills and make sure that these girls do participate. This helps girls to be very sure of their abilities and capabilities as well as increasing their confidence in the field of STEM.
- Women should also be well represented especially in all exhibitions and not those with female-themed topics. Unconscious beliefs about man as the scientist or engineer or a mathematician may mean that women and girls are under-represented in exhibit materials or are portrayed mainly in auxiliary roles.
- Despite a lot of emphasis for inclusive education, single-sex schooling has turned to be a favourable condition that encouraged girls to continue to Advanced level science classes. It turned out that girls are still more likely to stick with science if they have single-sex schooling and especially having a parent as a role model in science field.

Suggestions for further Research.

This research was predetermined with assessing the extent of girl child participation in science subjects at Advanced level in Zimbabwe after the introduction of the STEM Initiative using the Case Study of Glen View Schools only. The research was not exhaustive and not inclusive given the circumstances that it only focused on schools in one urban suburb of a single city. Also, it did not even have a look at the extent of girl child participation in rural areas too. Therefore, the researcher recommend that there is need for further research in this same field and same topic but using different case studies in some other areas of Zimbabwe, both rural and urban, mission schools and governments schools as well as comparing the numbers, whether they are increasing or decreasing in single-sex schools in this chase the girls high schools.

In a nutshell, it is the belief of the researcher that if the data collected in the field for this research and the results, conclusions and recommendations are taken seriously, the extent of girl child participation will improve and the Government of Zimbabwe's STEM Initiative will be a

celebrated success in promoting the uptake of science subjects by girls at Advanced level in Zimbabwe resulting in the meeting of the demand for STEM personnel required for national industrialization.

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APPENDIX 1: INTERVIEW GUIDE: FOR MINISTRY OF PRIMARY AND SECONDARY RDUCATION OFFICIALS AND THE ZIMBABWE MANPOWER DEVELOPMENT FUND.

1. What is STEM?
2. How is STEM important to the girl-child?
3. What can you comment on extent of the participation of girls in science subjects at Advanced level before and after the introduction of the STEM Initiative?
4. In the student selection, are you putting the gender dimension into consideration?
5. As ZIMDEF, what is it that you are doing to close the gender gaps that exist between boys and girls in as much as their participation in sciences at Advanced level is concerned?
6. Can you explain where are you coming in from in the funding of STEM?

APPENTIX 2: INTERVIEW GUIDE FOR SCHOOL HEADS AND TECHERS.

1. For how long have you been teaching sciences at Advanced level?

2. What can you comment on extent of the participation of girls in science subjects at Advanced level before and after the introduction of the STEM Initiative?

3. As a teacher, what are you doing to encourage the girls at lower levels to take part in sciences?

As a school department of science, what are you doing to encourage the girls at lower levels to take part in sciences as well as closing the gender gap that exist in education especially in sciences?

4. What factors do you think are contributing to poor participation of girls in STEM subjects at Advanced level?

5. Can you explain how do you treat girls and boys in your class?

Do you treat them equally?

Yes	No

Can you support your answer?

6. What do you think can be done to encourage girls to participate in STEM Initiative especially at Advanced level?

7. How effective do you think the STEM Initiative will be in promoting the girl-child's highest level of science subject uptake at Advanced level?

APPENDIX 3: QUESTIONNAIRE FOR GIRL CHILD STUDENTS.

PLEASE DON'T WRITE YOUR NAME, ID NUMBER OR CONTACT DETAILS

1. Parental Occupation.....

2. Number of children in family…….....

3. Are you the first or last born? ……

4. Do you understand what STEM is all about?

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5. What influenced you to like STEM subjects at Advanced level?

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6. What do you want to do after completing advanced level and what is your motivation?

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7. What factors do you think are contributing to poor participation of girls in STEM subjects at Advanced level?

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8. Are there any preferential differences in the way teachers treat the boy and the girl-child in during lessons in classrooms and after school?

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9. What do you think can be done to encourage girls to participate in STEM Initiative especially at Advanced level?

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APPENDIX 4*:* QUESTIONNAIRE FOR SCIENCE TEACHERS

PLEASE DON'T WRITE YOUR NAME, ID NUMBER OR CONTACT DETAILS

1. Gender

Male	Female

2. How long have you been teaching sciences?

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3. Can you comment on the extent of girls' participation in science subjects at your school before and after the launch of the STEM Initiative by the government?

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4. Is the STEM Initiative effective enough to close the gender gaps that exist between boys and girls in Zimbabwe's Advanced level science classes?

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5. What are you think are the cause of the girl child's poor uptake of sciences at Advanced level?

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6. Is there any strategies lined up or action taken by the Government and its subsidiary branches, Non-governmental Organizations or the Business Community to improve the STEM Initiative's gender sensitivity e?

Yes	No

If the answer is *YES*, give an account of what has been done so far to improve the participation of girls in STEM subjects.

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7. How effective are these strategies and actions effective in promoting girl child science education.

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8. What do you think can be done to improve the STEM subjects' uptake by female students at Advanced level?

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9. What are the challenges that are being faced promotion of girl child education in Glen View Mufakose District in the STEM field?

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